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A DIAGNOSIS OF DIFFICULTIES ENCOUNTERED IN THE LAZERTE SURVEY TESTS IN ARITHMETIC

A DISSERTATION

SUBMITTED TO THE FACULTY OF EDUCATION IN

PARTIAL FULFILMENT OF THE REQUIREMENTS FOR

THE DEGREE OF BACHELOR OF EDUCATION

BY

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FOREWORD

Numerous men have made analytical reports of detailed investigations on the subject of Arithmetic. A very large number of these investigations have been completed in the United States. In 1940 Dr. M. E. LaZerte, Dean of the Faculty of Education in the University of Alberta, prepared a series of Survey Tests for use in each of the public school grades. This set of tests forms the basis for this investigation.

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CHAPTER I

INTRODUCTION

Arithmetic has long been considered a fundamental subject on the school curriculum. Foremost in the criteria of judging the school was the achievement of its scholars in arithmetic. In the school itself, the chief criterion for promoting the student was his ability in arithmetic; and to a marked extent that is still true. There have always been students who showed a marked inability to master the subject. Long pedagogical theory has not yet established the best method of presenting it. Various theories have been advanced regarding the psychology of learning arithmetic. But any sound theory must have its basis on a reliable diagnosis of the existing conditions. Diagnostic tests may seek to determine particular features of a procedure that indicate the cause of a pupil's difficulty; or a broader field would be to determine the ability of the pupil in a general survey by giving examples of many types, each of which represents the requirement of a different combination of skills. The LaZerte Survey Tests are of this latter type and are conceived to give a comprehensive survey of the existing condition of arithmetic in the public schools.

PRELIMINARY WORK

In December, 1940 a testing program in arithmetic was inaugurated following the 1940 Summer School course on the Psychology and Supervision of Arithmetic. At that time about nine thousand copies of the tests were sent to Alberta schools. A report concerning that test was published in the February(1941) number of the Alberta Teachers' Magazine. The second step in the testing program came in May when another nine thousand copies of a second test were sent to the schools. These tests were prepared by Dr. M. E. LaZerte of the Faculty of Education in the University of Alberta. Considerable attention was given to their preparation for a survey to establish definite evidence of the goals of attainment in arithmetic achieved by children attending

the public schools. The tests were written by pupils from Grades II to IX inclusive under the supervision of the teachers. The papers were then returned to the University. From these answer papers, sixteen hundred , representing a sample of two hundred from each grade, were marked in the summer of 1941 and the data tabulated. A chart of the norms based on that data was published in the September (1941) number of the Teachers' Magazine. The complete data on this second set of tests represent the basis of this thesis.

OBJECTIVES

Success in the presentation of arithmetic requires clear comprehension of the standards to be attained and the nature of the common difficulties. These tests should have as one objective the establishment of provincial norms for teachers' reference in analyzing , for correction, the problems of the pupils. The Number Highways 6 gives special mastery tests. It is a recognized feature of the course of study in arithmetic that instruction must be based on effective diagnosis followed by remedial teaching. Mere marking of a child's work from day to day is most ineffective, when this underlying principle is disregarded. The use of these Survey Tests should give a basis for an intelligent analysis of difficulties, which if carefully recorded, will enable the teacher to correct the individual faults of pupils. Use of the tests merely for comparison of a class with a norm lacks realization of their potential value. Analysis, recording, and corrective instruction for the errors revealed, must follow.

This dissertation is not intended as a treatise on remedial teaching but rather as an analysis of the quantitative and qualitative nature of the problems revealed in the LaZerte Survey Tests in their use in the Alberta schools in May, 1941.

CHAPTER II

COPIES OF THE SURVEY TESTS

It is generally accepted that survey tests are used to determine how the achievements of a class or of pupils in a class compare with standards or norms of accomplishment. But, as was indicated in Chapter I, the giving of a survey test is only the first step in an effecyive testing program. Students' errors must be diagnosised and corrected. It would appear that the time for such a test would be early in the year so that the teacher could make an analysis of difficulties and adjust the teaching procedure in the light of that. There is much that is commonly forgotten in the summer vacation that might be thus revealed. Then too, in a system of administration that brings a new teacher frequently into a school at September, there is need that he or she should know the area of the field to be covered in the arithmetic course of each grade. It follows from what has been said that the test must be completely reprsentative of the course of study for the particular grade. Examination of the tests in this chapter will show that careful regard has been given to the factual requirements stated by the Course of Study for each particular grade.

Most of the tests were too long for one sitting; they are very comprehensive and no time limit is stipulated. Most of them require two sessions of writing and therefore are in sections. Thus Part A and Part B represent sections written at different sessions. All the grades, except Grade VIII, had at least two sections on the tests. Grade VI had three sections and Grade IX, having two sections of Geometry as well as one of Algebra, also had three sections representing three periods of writing.

A copy of the instructions sent to teachers is included in the chapter. Copies of the keys to the tests follow in Chapter III.

INSTRUCTIONS RE. SURVEY TESTS IN ARITHMETIC

A. INSTRUCTIONS TO TEACHERS

(a) General

1. All but the slowest pupils should be allowed all the time required to finish the test.

2. Before pupils begin the test make certain that all data required to be entered in the blanks at the top of the test are complete.

3. See that pupils have provided themselves with pencils, rulers, and necessary drawing instruments.

4. Each test begins with the spelling of a list of words. The teacher should dictate these rather slowly, pronouncing each word and giving its use in a sentence. The spelling lists for the various grades are to be found on the grade keys.

5. In Grade 11 the teacher is to read the questions with the pupils as they do them but in other grades no assistance is to be given.

6. See that the time given each pupil to the test is recorded on the test paper as soon as the pupil completes his work.

7. No deductions are to be made for mistakes in spelling except in the Spelling Test.

8. Both the December and the May tests are sectioned. Generally the entire test is to be taken at two sittings. Arrange to have Part A of the test done in the forenoon and the second part in the afternoon of the same day.

9. Please try to give tests within five days of December 15th or May 31st. Where more than one class in your school or vicinity is to take the test, they should all take it at the same time.

10. After marking papers, tabulate any information you wish to use, and then kindly forward tests for study to M. E. LaZerte, College of Education, University of Alberta, Edmonton. We suggest that you use the December 15th test as your Christmas test for your report. It will therefore be marked in December and you can forward it to the University before the Christmas holidays. The May 31st test should be forwarded not later than June 15th.

11. These test results will be used in two ways. You will use them in educational guidance of individual pupils. You are testing the pupils knowledge of the course. This means that there is to be no teaching in preparation for the test if we are to get a true picture. We hope to use the test results in obtaining provincial norms. Your school is not being graded.

(b) Re. Particular Grades

Grade 11 -- Explain the pictures.

Teachers should read the entire test through with pupils as they work, except the combinations and

separations. Make certain that the pupils follow the questions correctly and that they put the answers in the blanks.

B. Instructions to be read to pupils

(a) General

1. This is not a timed test. Do Not hurry. Work carefully but do not waste time. If you cannot do a question, go on to the next one.

2. You may use pencil or ink, preferably pencil. If you are using pencil have two on hand if possible in case you need them.

3. All lists of spelling, computation, drawings, etc., are to be used by any pupil.

(b) Re. Particular Grades

Grade lll -- Teachers should tell pupils to use ink bottle top or some such object when they want to draw a circle.

Grade lV -- You may copy the division questions on the back of the sheets and work them there. Be sure to number them correctly if you do this. When finished with each question put the answer in its proper place on the front of the sheet.

Grades V, Vl and Vll --

Common fractions are in all cases to be reduced to lowest terms.

Grades Vlll and lX --

See graph paper on reverse side of sheet.

Lazerte's SURVEY TEST:ARITHMETIC, PART A Possible Score 125

Grade 11 May 31st. Pupil's Score; Test A _____

Test B _____

Total _____

Pupil's name_____ Sex _____

Age _____ Yr_____Mo_____Time (Spelling and copying of items included) Test A ___Min. Test B ___Min.

Name of School:_____Date_____

Part A

Add:

A.	3	2	42	43	115	325	
	3	1	21	30	213	131	13
	2	4	23	16	341	422	4
B	26	42	94	34	72	65	52
	3	5	5	4	7	5	2
C.	75	59	76	44	51	62	66
	4	1	2	4	7	8	3
D.	23	50	83				
	7	6	7				

Subtract:

E.	36	78	427	649	784	500	40
	12	53	215	405	460	200	-1
F.	39	60	46	78	54	40	58
	-2	-5	-3	-2	-4	-6	-4
G.	86	47	79	66	50	78	77
	-5	-4	-7	-6	-9	-8	-2
H.	60	79	69	48	77		
	-3	-4	-5	-3	-6		

A - 2-

Write from dictation:

(1) one hundred eight_____

(2) sixty _____

(3) one hundred forty _____

(4) one hundred thirty-nine ____

Fill in the blanks:

(5) 75, __ 85, __, ___, 100, ___,___.

(6) 110,___, ___, 140, 150, ___.

(Grade 11 A-2- continued)

By how many is

(7) 200 greater than 180? _____ (8) 60 less than 100? ____

Write in words:

(9) 6; _____ (12) 9; _____

(10) 7; _____ (13) 10; _____

(11) 8; _____

(14) Color the circle that is seventh from the left-hand end.

(15) Put an X on the ninth circle.

(16) Put two X's on the sixth circle.

(17) Write the even numbers that come between 30 and 50

---

(18) 3 more than 25 is _____

(19) 3 more than 17 is _____

(20) 4 more than 25 is _____

(21) VIII means _____

(22) IX means _____

PART B: Grade 11. May 31st.

Pupil's Name_____Time _____ Min._____

Part B

Tom is 6 years old. Fred is 8 years old. Bill is 9 years old.

(1) Which boy is the oldest? _____

(2) Who is the younger, Fred or Tom? _____

(3) How many make a quartet? _____

(4) How many make a trio? _____

(5) 9 - 3 = _____

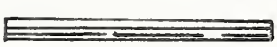
(6) + means _____

(7) Fill in with your pencil one-quarter of this drawing.

(8) Put an X on one-third of these apples.

A

B

C 

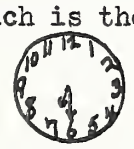
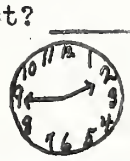
D

(9) Which stick is the thinnest?_____

(10) Which is the widest? _____

(11) Which is the shortest? _____

(12) Which is the longest? _____

(1) What time is it by the first clock? _____

(2) What time is it by the second clock? _____

(3) What time is it by the third clock? _____

(4) $\frac{1}{2}$ dozen = _____

(5) 1 quart = _____pints

(6) $\frac{1}{2}$ foot = _____ inches

(7) 1 yard = _____inch es.

B - 3

(1) If 1 stick of candy costs 4 cents, how much must I pay for two sticks of candy? _____

(2) What is the difference between 20 and 3? _____

(3) A boy who had 18 cents spent 5 cents. How much money had he left? _____

(Grade 11, B-3 Continued)

(4) Marbles are 6¢ a dozen. How much will 2 dozen cost? _____

(5) I have 9 pairs of rabbits. How many rabbits have I? _____

(6) What change should I get from 10¢ if I buy a street car ticket for 5¢ _____

(7) A piece of string is 30 inches long. If I cut off 2 inches of it, how many inches are left? _____

(8) Find the sum of 24 and 5. _____

(9) From 36 subtract 4. _____

(10) Mary is 17 years old. Jean is 12 years old.

How many years is Mary older than Jean? _____

LAZERTE'S SURVEY TEST:ARITHMETIC TEST A Possible Score 131

Grade III, May 31st.

Pupil's Score Test A _____

Test B _____

Total _____

Pupil's Name _____ Sex _____

Age _____yr_____ mo_____ Time Spelling and copying of items included) Test A___min. Test B___min.

Name of School _____ Date _____

Test A

Write in the following spaces the words as they are dictated;

Vocabulary (Spell from dictation).

1._____ 6._____ 11._____

2._____ 7._____ 12._____

3._____ 8._____ 13._____

4._____ 9._____ 14._____

5._____ 10._____ 15._____

Language

Write the abbreviations for:

(1) pint _____ (5) hour _____

(2) Quarts _____ (6) yard _____

(3) ounce_____ (7) inches _____

(4) pound _____ (8) week _____

Use one of the following words correctly in each of the sentence blanks below: quotient, remainder, divided, sum, two, three, ounces, product.

(9) The _____ of 18 and 14 is 32.

(10) The_____ of 5 and 8 is 40.

(11) The _____ when 70 is _____ by 5 is 14.

(12) There are 32 _____ in _____ pounds.

Activities

(1) Draw a line that is half as long as this line _____

(2) Draw the line here:

(3) Draw a square that has each side $1\frac{1}{2}$ inches long.

(4) Draw a circle and shade one-third of it.

Denominate numbers (Continued)

(1) 1 qt. _____pt.
(2) 1 yd. _____ft.
(3) 1 lb. _____oz.
(4) 1 ft. _____in.
(5) 2 wk. _____days
(6) 11pt. _____qt. and ___pt

(7) $\frac{1}{2}$ of \$3.60 =_____
(8) 15 ft. = _____yd.
(9) $\frac{1}{4}$ lb. =_____oz.
(10) 7 $\frac{1}{4}$ ft. = _____ in.
(11) 5 yd. =_____ft.
(12) 6 pt. = _____qt.
(13) 8 oz. =_____lb.
(14) 4 in. =_____ft.

(15) 120 min. = _____hr.

Fractions (Fill in the blanks).

(1) $\frac{1}{2} = \frac{\quad}{4}$
(2) $\frac{1}{3}$ doz. = _____
(3) $\frac{1}{3}$ of 15 = _____
(4) $\frac{1}{2}$ of 10 = _____
(5) 5 is $\frac{1}{4}$ of _____
(6) $\frac{1}{3}$ of _____ is 6.
(7) $\frac{1}{4}$ of 24 is _____
(8) $\frac{1}{2}$ min. = _____ sec.
(9) $1\frac{1}{2}$ hr. = _____ min.
(10) 2 $\frac{1}{3}$ ft. = _____in.

Fundamentals

Add:

(1) 23, 53, 79, 76 ___
(2) 35, 26, 87, 28 ___
(3) 347, 569, 385 ___
(4) \$3.38, 5.29, 3.45 ___

Subtract:

(1) 620 − 357 ___
(2) 923 − 469 ___
(3) \$5.00 − 2.76 ___
(4) \$6.25 − 3.69 ___

Multiply:

(1) 24 × 2 ___ ; 312 × 3 ___
(2) 46 × 2 ___ ; 39 × 2 ___
(3) 359 × 2 ___ ; 278 × 3 ___
(4) \$2.67 × 2 ___ ; \$1.95 × 3 ___
(5) 276 × 3 ___ ; 268 × 4 ___
(6) \$3.07 × 4 ___ ; \$1.66 × 5 ___

Divide:

(1) 2) 48 ___ ; 2) 106 ___
(2) 2) 74 ___ ; 2) 720 ___
(3) 3) 69 ___ ; 3) 240 ___
(4) 3) 231 ___ ; 3) 714 ___

-3- (Grade III. May 31st.)

Divide: (Cont.)

(5) $2\overline{)57}$ $3\overline{)295}$ (6) $4\overline{)84}$ $4\overline{)92}$

(7) $4\overline{)372}$ $4\overline{)713}$ (8) $5\overline{)75}$ $5\overline{)405}$

(9) $5\overline{)623}$ $5\overline{)371}$ (10) $4\overline{)\$6.11}$ $5\overline{)\$3.40}$

Grade III

TEST B May 31st.

Pupil's Name _____ Time _____ min.

Test B

Generalizations.

1. How can you change a given number of feet to inches?

_____

2. How can you change a given number of pints to quarts?

_____

3. How can you change a given number of feet to yards?

_____

4. How can you find how many days there are in a given number of weeks?

_____

Problems

1. There are 12 inches in 1 foot. There are three feet in one yard. How many inches are there in 1 yard.

2. Ask a question that will make a problem in addition.

   I walked 10 miles on Monday.

   I walked 8 miles on Tuesday.

   Question; ? _____

3. Ask a question that will make a problem in subtraction.

   We spent 30 cents for a cake for our party.

   We spe nt 50 cents for ice cream.

   Question; ? _____

4. What is the cost of 2 hats at $6.00 each? _____

5. A trip of 163 miles and back again would be how many miles altogether? _____

6. Five boys bought tickets for the movies. The tickets cost 25¢ each. How much did they pay for the five tickets? _____

7. Four more than five times seven is _____

8. What is the remainder when 75 is divided by two? _____

9. If two pints of milk cost 16¢. How much does one pint cost? _____

10. Four boys buy a present that cost $2.40. If each boy pays the same amount, how much does each boy pay? _____

11. Cloth costs 60¢ a yard. How much does 4 yds. of it cost? _____

12. Find the total cost of 3 doz. oranges at 45¢ a dozen and $\frac{1}{2}$ lb. candy at 30¢ a pound? _____

LAZERTE'S SURVEY TEST: ARITHMETIC TEST A

Grade IV May 31st.

Possible score 118
Pupil's score Test A_____
Test B_____
Total_____

Pupil's Name_____ Sex_____

Age_____yr_____Mo_____ Time: (Spelling and copying items included) Test A____min. Test B____min.

Name of School_____ Date_____

Test A

Spelling

Write the words dictated by the teacher.

1._____	7._____	13._____
2._____	8._____	14._____
3._____	9._____	15._____
4._____	10._____	16._____
5._____	11._____	17._____
6._____	12._____	18._____

Language

L. If you know the weight of each of four girls, how can you find their average weight?_____

_____

2._____

_____

_____

_____

Measure these four lines and then draw a line whose length is the average length of the four.

Draw the line here:

3. What is the rule of multiplying a number by 100?

_____

4. How can you find the number of gallons when you know how many quarts there are?_____

5. Underline the statement which is true:

(a) A rectangle has four sides.

(b) All the sides of a rectangle are equal.

6. If you are given a length in rods, how can you change this to yards?

_____

Denominate Numbers

(1) 5 pt. =_____qt. (2) $1\frac{1}{2}$ min. =_____sec.

Denominate Numbers (cont'd)

(3) 2 da. = _____ hr. (4) 60 = _____ doz.

(5) $1\frac{1}{6}$ ft. = _____ in. (6) $3\frac{1}{2}$ lb. = _____ oz.

(7) 12 qt. = _____ gal. (8) 2 bus. = _____ pk.

(9) 15 in. = _____ ft. (10) 13 pt. = _____ qt.

(11) Weights of bushels of grains are:

(a) 1 bu. wheat = ___ lb. (b) 1 bu. oats = _____ lb.

(c) 1 bu. barley = ___ lb.

(12) 4 oz. = _____ lb. (13) 3 cwt. = _____ ton

(14) Fill in the blanks:

A rectangle _____ ft. long and 6 ft. wide has an area of 40 sq. ft.

(15) 1 rod = _____ yd. (16) 1 mile = _____ rods.

(17) 1 mile = _____ yd. (18) 5 ft. 7 in. = _____ in.

(19) 2 yr. 9 mo. = _____ mo.

Fractions

(1) $\frac{1}{2} = \frac{\quad}{6} = \frac{\quad}{4} = \frac{\quad}{8} = \frac{\quad}{12}$ (2) $\frac{1}{8}$ of 56 = _____

(3) $\frac{1}{6}$ of 72 = _____ (4) $\frac{1}{9}$ of 180 = _____

(5) $\frac{1}{9} + \frac{1}{9} + \frac{1}{9} =$ _____ (6) $\frac{1}{2} - \frac{1}{4} =$ _____

(7) $\frac{1}{3} - \frac{1}{6} =$ _____

(8) How many sixths in one-half? _____

(9) $3\frac{1}{2} - 2\frac{1}{4} =$ _____ (10) $5\frac{1}{2} + \frac{1}{4} =$ _____

(11) $3\frac{1}{2} + 2\frac{1}{2} =$ _____ (12) $\frac{1}{3} + \frac{1}{6} =$ _____

TEST B

Grade 1V May 31st.

Pupil's Name _____ Time _____ min.

Add:

(1) 3265 5783 (2) $5.37 $8.25
1794 2998 2.99 4.49
7686 6457 3.49 3. 74
6.75 2.95

Subtract:

(1) 5361 6052 (2) 7000 6104
2824 3628 2946 3761

Multiply:

(1) 100 x 7 = _____ (2) 100 x 20 = _____

(3) 10 x 62 = _____ (4) 10 x 326 = _____

(5) 10 x 631 = _____ (6) 100 x 48 = _____

(7) $46.85 $37.29 (8) 16 63
7 8 20 80

(9) 345 128 (10) 472 256
70 60 46 73

Division:

(1) 7) 5604 6) 4138 (2) 20) 160 40) 360

(3) 30) 450 70) 4200 (4) 40) 562 60) 812

(5) 9) $57.30 8) $78.26

Problems:

(1) Find the average of these lengths:

30 in., 42 in., $3\frac{1}{2}$ ft., 44 in., $2\frac{1}{4}$ ft. _____

(2) I have $5.00. How much money will I have left if I buy 6 tickets for a rugby game at 65¢ each? _____

(3) Find the cost of 90 lb. of potatoes at 80¢ per bushel. _____

(4) How much does a milkman get for 5 gal. of milk if he sells it for 11¢ a qt? _____

(5) Estimate as accurately as you can the cost of $8\frac{1}{2}$ lb. meat at $34\frac{1}{2}$¢ a lb. _____

Problems: (Cont).

(6) This line represents $10. _____

Draw a line here

that will represent $15.

(7) A rectangle is 6 ft. long and 2 ft. 6 in. wide. Its area in sq. ft. is _____

(8) How do you find the perimeter of a rectangle if you know its length and its width ? _____

(9) Rewrite the following measures giving each to the nearest foot:

(a) 3 ft. $8\frac{1}{2}$ in. _____ (b) 5 ft. $5\frac{3}{4}$ in. _____

(10) At 15¢ a dozen, how much should I pay for 72 eggs? _____

(11) If I walk 1 mile in 20 minutes, how far will I walk in $2\frac{1}{2}$ hours at this rate? _____

(12) Imagine that you are a store keeper. Make out a sales slip for the following groceries bought by Mrs. A. Brown on March 20th, 1940.

3 lb. bacon at 45¢ a lb.

4 loaves bread at 10¢ a loaf.

2 lb. butter at 23¢ a lb.

1 lb. tea at 48¢.

LAZERTE'S SURVEY TEST: ARITHMETIC TEST A

Possible Score 153

Grade V May 31st.

Pupil's Score Test A _____

Test B _____

Test C _____

Total _____

Pupil's Name _____ Sex _____ _____

Age _____ Yr _____ mo _____ Time (Spelling and copying of items included) Test A ___ min.

Test B ___min.

Test C ___min.

Name of School _____ Date _____

TEST A

Spelling Write the spelling dictated by the teacher.

1. _____ 6. _____ 11. _____

2. _____ 7. _____ 12. _____

3. _____ 8. _____ 13. _____

4. _____ 9. _____ 14. _____

5. _____ 10. _____ 15. _____

16. _____

Number System:

Write as decimals or as decimal fractions:

(1) seventeen and six-tenths _____

(2) ten and one-tenth _____

(3) one hundred four and four-tenths _____

(4) In 239.76 the 2 means _____

the 9 means _____

the 7 means _____

the 6 means _____

Language:

In examples where the number is divided by an integer:

(1) Is the quotient larger or smaller than the divisor? _____

(2) Is the remainder larger or smaller than the divisor? _____

(3) Is the remainder larger or smaller than the quotient? _____

(4) Is the temperature of 23 degrees FAHRENHEIT warmer or colder then the temperature of freezing water? _____ _____

-2- (Grade V, May 31st, Test A) .

Denominate Numbers (Cont'd).

(1) 2 bu. oats _____ lb. oats.

(2) $2\frac{1}{2}$ bu. wheat _____ lb. wheat.

(3) $1\frac{1}{2}$ bu. potatoes _____ lb. potatoes.

(4) What reading on the ordinary thermometer indicates "boiling temperature of water"? _____

(5) Measure this line _____ to the nearest $\frac{1}{4}$ inch. Length. _____

(6) $\frac{5}{8}$ mile = 1_____yd. (7) 10 rods = _____yd.

(8) 1 yd. 2 ft. = _____ in. (9) 5 yd. 2 ft. = _____ ft.

(10) 50 inches = _____yd. _____ft. _____in.

Fractions:

(1) Shade the fraction of the circle indicated.

(2) Which is larger $\frac{7}{12}$ or $\frac{1}{2}$. _____

(3) Of the following $\frac{9}{8}$, $\frac{7}{8}$, $2\frac{1}{4}$, $\frac{5}{6}$, $\frac{6}{7}$, $\frac{11}{10}$, $10\frac{1}{11}$, $\frac{1}{7}$, $5\frac{1}{4}$, $\frac{4}{9}$, $\frac{10}{11}$.

(a)_____ are proper fractions.

(b)_____ are improper fractions.

(c) _____ are mixed numbers.

(4) $3 - \frac{5}{6}$ = _____

(5) Change the following improper fractions to mixed numbers:

$\frac{13}{6}$, $\frac{9}{5}$, $\frac{17}{8}$, $\frac{21}{9}$, $\frac{27}{5}$, $\frac{51}{7}$.

(6) $\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$ = _____ (7) $5\frac{3}{8} + 2\frac{1}{8}$ = _____

(8) $7\frac{2}{5} + 1\frac{3}{5}$ = _____ (9) $4\frac{2}{9} + 2\frac{8}{9}$ = _____

(10) $12\frac{6}{7} - 5\frac{2}{7}$ = _____

(11) The ground plan of a house is drawn to the scale 1" - 6 ft. If the house is 40 ft. long and 28 ft. wide, what are the dimensions of the drawing? _____

(12) $\frac{1}{2} + \frac{3}{4}$ =_____ (13) $\frac{2}{3} + \frac{5}{9}$ = _____

(14) $\frac{1}{2} + \frac{5}{6}$ =_____ (15) $\frac{3}{5} - \frac{1}{2}$ =_____

(16) $\frac{7}{8} - \frac{3}{4}$ =_____ (17) $\frac{3}{4} + \frac{2}{3}$ =_____

(18) $\frac{3}{4} + \frac{5}{6}$ =_____ (19) $\frac{5}{12} - \frac{1}{4}$ =_____

TEST B

Grade V May 31st.

Pupil's Name_____ Time _____ min.

Test B

Add:

(1)

769	923
489	486
384	748
820	826
388	888

(2)

$32.67	$45.71
22.78	4.28
3.67	12.36
5.89	2.19
32.25	47.16

(3)

$3\frac{1}{2}$	$4\frac{3}{8}$
$4\frac{1}{8}$	$2\frac{1}{2}$

(4)

$4\frac{2}{3}$	$6\frac{7}{8}$
$1\frac{1}{9}$	$4\frac{3}{8}$

(5)

3 ft. 7 in.
2 ft. 8 in.

(6)

3 yd. 2 ft.
3 yd. 1 ft.

(7)

6 qt. 1 pt.
3 qt. 0 pt.
4 qt. 1 pt.
2 qt. 1 pt.

(8)

4.1	5.3
3.7	4.8
8.6	11.4

(9)

3.06	5.16
1.47	4.8
4.72	2.78

Subtract

(1)

314201	516121
167259	257786

(2)

$713.24	$6324.25
526.09	1788.67

(3)

8.2	5.8
4.7	1.8

(4)

20.0	14.8
7.2	14.2

Multiply:

(1)

576	466
29	58

(2)

427	396
359	628

(3)

$93.76	$426.15
47	58

Division:

(1) $20\overline{)160}$ $60\overline{)480}$ (2) $30\overline{)290}$ $50\overline{)370}$

(3) $21\overline{)186}$ $41\overline{)350}$ (4) $23\overline{)450}$ $82\overline{)700}$

(5) $75\overline{)674}$ $46\overline{)391}$ (6) $69\overline{)560}$ $78\overline{)612}$

(7) $436\overline{)30733}$ $278\overline{)30695}$

TEST C

Grade V May 31st.

Pupil's Name_____Time _____min.

Test C

Problems:

(1) The 32 pupils in our room took 296 books from the library during the year. On the average how many books was this per pupil?

(2) Which will cost more, 85 books at 40¢ ea. or 65 books at 55¢ each?

_____.

How much more will they cost? _____

(3) My desk is $40\frac{1}{2}$" long and $26\frac{1}{4}$" wide. By how many inches is the length greater than the width? _____

(4) How long will it take a car averaging 48 miles an hour to make a trip of 741 miles? _____

(5) On a map two towns that are actually 250 miles apart are represented by two dots $2\frac{1}{2}$ in. apart. What is the scale of the map? _____

(6) Find the value of 2130 lb. wheat at 80¢ a bu. _____

(7) The 26 boys in our school sold $125.32 worth of tickets and the 34 girls sold $180.54 worth. Who averaged higher, the boys or the girls, in the sale of the tickets? _____

How much higher? _____

(8) How is the value of a common fraction changed if both numerator and denominator are multiplied by the same number? _____

(9) Suppose I mix together 20 lb. sand, 12 lb. clay and 18 lb. gravel. What fraction of the total weight is sand? _____

(10) In a farm 2 miles long and 1 mile wide there are _____ acres.

(11) $2.50 per day = _____ per week. (Sunday included).

(12) 20¢ a pint = _____per gal.

(13) 20 ft. per sec. = _____ ft. per min.

(14) 24¢ a lb. = _____ per oz.

LAZERTE'S SURVEY TEST ARITHMETIC TEST A

Grade VI May 31st.

Possible Score

Pupil's Score Test A_____

Test B_____

Test C_____

Total _____

Pupil's Name_____Sex_____

Age _____yr_____mo_____ Time (spelling and copying of items included)

Test A___min.

Test B___min.

Test C___min.

Name of School_____Date_____

Test A

Spelling: Write in the following spaces the words as they are dictated.

1._____ 5._____ 9._____

2._____ 6._____ 10._____

3._____ 7._____ 11._____

4._____ 8._____ 12._____

Number system:

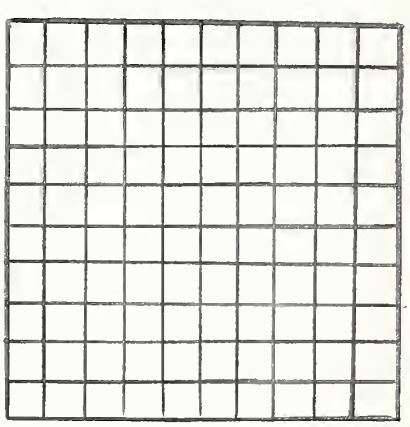
(1) What fraction of a dollar does the 2 represent in $45.27?_____

(2) Which is more nearly equal to 1 the decimal 1.2 or the decimal fraction 0.7? _____

(3) In corner A shade in 0.02 of the big square.

(4) In corner B shade in 0.1 of the big square.

(5) In corner D shade in 0.14 of the big square.



(6) Write the decimal that means 15 $\frac{24}{1000}$ _____

(7) When written to the nearest tenth of a foot, 10,73 ft. becomes_____

Languages:

(1) Write 4 per cent as a common fraction._____

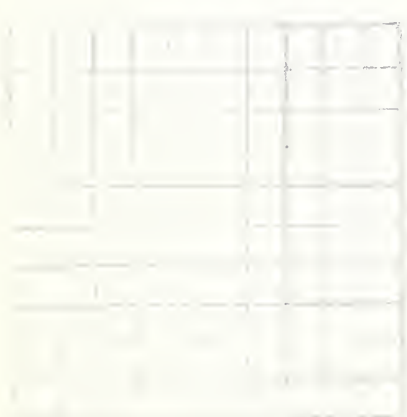
(2) How can you find the number of cubic feet in a volume if you know the volume in cubic inches?_____

_____

(3) What is the approximate value of 39.84 x 5.04? Value:_____

(4) Which is larger 100 quarter sections of land or 1 township?

_____How great is the difference?_____



-2- (Grade VI, Test A, May 31st.)

Denominate Numbers

(1) 1 cu. ft. = _____cu. in. (2) 1 cu. yd. = _____cu.ft.

(3) 1 rod. = _____ft. (4) 1 sq. rd. =_____sq.yd.

(5) 1 right angle = ___ degrees.

(6) From 10 degrees East longitude to 70 degrees West longitude is

_____ degrees.

Common Fractions:

(1) Simplify $\frac{3\frac{1}{2}}{5}$ (2) Simplify $\frac{5\frac{1}{2}}{3\frac{1}{4}}$

(3) $\frac{3}{4} - \frac{5}{12}$ = _____ (4) $\frac{9}{10} + \frac{3}{5}$ = _____

(5) Change to an improper fraction, $4\frac{1}{5}$ _____

(6) Reduce to lowest terms.

$\frac{54}{63}$ = _____ $\frac{40}{56}$ = _____ $\frac{42}{66}$ = _____

(7) $\frac{6}{8} \times \frac{4}{9}$ = _____ (8) $\frac{12}{14} \times \frac{3}{4}$ = _____

Decimals and Decimal Fractions:

(1) Write as mixed numbers:

3.6 = _____ 2.25 = _____ 4.03 = _____

(2) Write as decimals or as decimal fractions:

$2\frac{1}{5}$ = _____ $\frac{7}{50}$ = _____ $\frac{2}{25}$ = _____

(3) Place the decimal points correctly:

(a) 1.6 x 24.4 = 3904 (b) 1.9 x 2.4 = 456

(c) 0.9 x 0.7 = 63 (d) 1.1 x 0.365 = 4015

(e) 0.48 x 2.3 = 1104 (f) 0.62 x 100 = 62

(4) Find to the nearest tenth the value of 81.47 x 14.83 _____

TEST B

Grade VI. May 31st.

Pupil's Name _____ Time _____ min.

Add:

(1)
343
148
754
692
579
846

(2)
$3064.25
15.60
347.89
2.50
16.80

(3)
9 hr. 43 min.
12 hr. 48 min.

(4) $17\frac{2}{3} - 4\frac{3}{4} =$ _____

(5) $9\frac{1}{2} + 2\frac{3}{5} =$ _____

(6)
43.27
6.8
9.34
25.5

(7)
12 miles 80 rods.
8 miles 100 rods.
5 miles 60 rods.

(8) $\frac{2}{3} + \frac{3}{4} + \frac{1}{2} + \frac{5}{8} =$ _____

Subtract:

(1)
5206102
3498756

(2)

gal.	qt.
17	1
12	3

(3)

acres	sq. rds.
14	85
7	140

(4) $\frac{5}{8} - \frac{3}{12} =$ _____

(5) $\frac{1}{2} - \frac{3}{7} =$ _____

(6) $17\frac{1}{3} - 5\frac{3}{4} =$ _____

(7) $4\frac{1}{3} - 2\frac{3}{5} =$ _____

(8)
49.24
13.8

(9)
36.6
5.92

(10)
63.24
5.777

Multiply:

(1)
5239
8

(2)
4378
37

(3)

cwt.	lb
15	62
	3

(4) $5\frac{1}{4} \times \frac{4}{9} =$ _____

(5) $4\frac{1}{5} \times 1\frac{4}{5} =$ _____

(6) $1\frac{7}{8} \times \frac{8}{15} =$ _____

(7) $8.5 \times 3.4 =$ _____

(8) $6.24 \times 0.8 =$ _____

(9) $0.17 \times 0.19 =$ _____

Division:

(1) $38\overline{)9628}$

(2) $563\overline{)216501}$

(3) $3\frac{3}{5} - 1\frac{1}{5} =$ _____

(4) $7\frac{1}{3} - 1\frac{2}{9} =$ _____

(5) $42\overline{)35.2}$

(6) $0.25\overline{)0.1475}$

(7) $0.13\overline{)0.0286}$ correct to 3 places

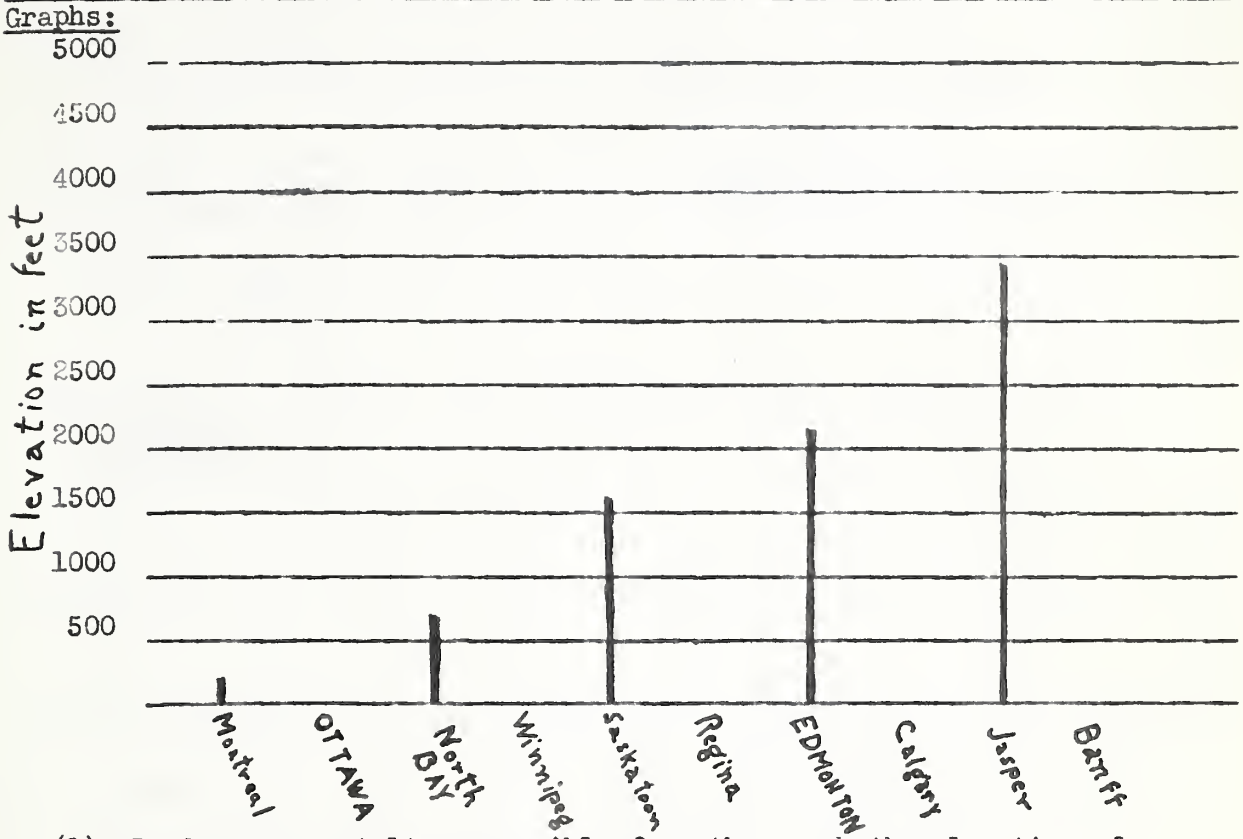
(8) $12\overline{)25 \text{ gal. } 2 \text{ qt.}}$

TEST C

Grade VI May 31st.

Pupil's Name _____ Time _____ min.

Graphs:



(1) Read as accurately as possible from the graph the elevation of each of the following cities:

Montreal: _____ North Bay: _____

Saskatoon: _____ Edmonton: _____

Jasper: _____

(3) Add bars to the graph tp show the following elevations as accurately as possible:

Ottawa : 214 ft. Winnipeg: 772 ft.

Regina 1896 ft. Calgary: 3438 ft.

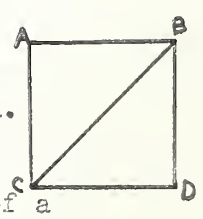
Banff: 4534 ft.

Problems:

(1) George is $4\frac{1}{2}$ ft. tall. Frank is $5\frac{1}{4}$ ft. tall. George's height is what fraction of Frank's height? _____

(2) $5\frac{1}{4}$ yd. ribbon costs 60¢. $3\frac{3}{4}$ yd. ribbon costs _____

(3) A rectanglular solid is $2\frac{1}{2}$ ft. long, $1\frac{1}{2}$ ft. wide and 10 in. deep. Its volume is _____ cu. in.



(4) The diagonal B. C. of a square is 1.414 times the length of a side. If one side is 75 ft. long, find the length of the diagonal.

_____

(5) A certain kind of sheet metal is 0.075" thick and weighs 4.25 lb. per sq. ft.

Problems: (cont'd)

5. (a) Find the thickness of a pile of 60 of these sheets.

_____

(b) Find the weight of a sheet of this metal 4.5 ft. square.

_____

(6) At $2.75 a sq. yd. find the cost of laying linoleum on a floor 12 ft. long and $10\frac{1}{2}$ ft. wide. _____

_____

(7) Ottawa is 75 degrees west longtitude. Jasper, Alberta is 119 degrees west longtitude. What time is it in Ottawa when it is 12 noon, sun time, at Jasper? _____

(8) A field is 26 rods long and 18 rods wide. Its area is _____ _____ acres.

(9) The grade Vl pupils had 50 words to spell in a review lesson. Jean spelled 35 of them correctly. What percent of the words did she spell correctly? _____

(10) Jack has 20 pages left to read in a 60 page book . What percent of the book has he read? _____

LAZERTE'S SURVEY TEST ARITHMETIC TEST A POSSIBLE SCORE 106

Grade VII - May 31st.

Pupil's Score Test A _____

Test B _____

Total _____

Pupil's Name _____ Sex _____

Age _____ yr _____ mo. _____ Time (Spelling and copying of items included.) Test A _____ Min.

Test B ____ Min.

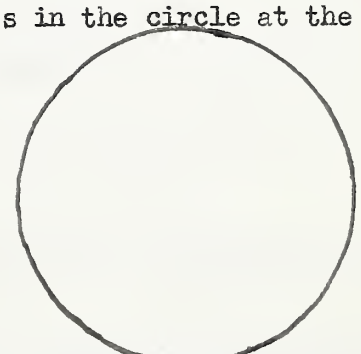
TEST A

Spelling

1. _____	12. _____	23. _____
2. _____	13. _____	24. _____
3. _____	14. _____	25. _____
4. _____	15. _____	26. _____
5. _____	16. _____	27. _____
6. _____	17. _____	28. _____
7. _____	18. _____	29. _____
8. _____	19. _____	30. _____
9. _____	20. _____	31. _____
10. _____	21. _____	32. _____
11. _____	22. _____	33. _____

Graphs

(1) Show graphically the following facts in the circle at the right.



logs and bolts 35,000,000

pulpwood 40,000,000

firewood 30,000,000

hewn railway ties 4,000,000

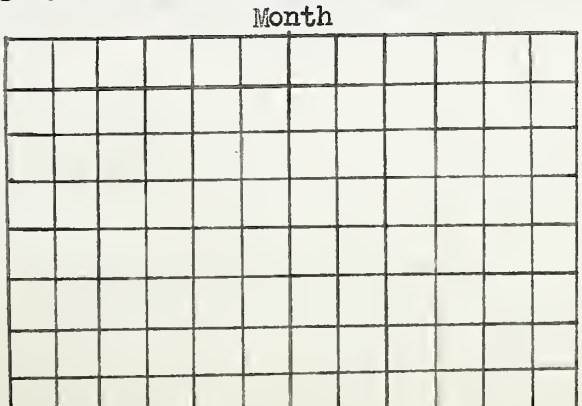
Other products 11,000,000

(2) The monthly average temperatures of a town A were as follows in 1939:

Month	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temp. (Degrees Fah.)	24	25	34	46	56	65	72	70	65	54	38	35

Draw a line graph to show these facts:

Month



Interest and Insurance

(1) My house is worth $6000. It is insured for 80% of its value. Find the annual premium at $\frac{1}{4}$% per year _____

(2) What would the annual premium be in problem above if for a 3-year policy the rate is 70% per $100. _____

(3) Fill in the blanks:

Principal	Rate	Time	Interest	Amount
$850.	3%	4 yr.		
$1200.		3 yr.	$90.	
	5%	$2\frac{1}{2}$ yr.	$100.	
		5 yr.	$40.	$240.

Language

Write the algebraic expression that means:

(1) The sum of 2a, 3b and 5c _____

(2) The difference between 2x and 3y _____

(3) The product of 2 and y and z _____

(4) The quotient when 12x is divided by 5y _____

(5) x is one more than y _____

(6) The product of 2n and 5n _____

(7) Half the sum of a and b _____

(8) Four less than the product of 3a and 2b _____

(9) Seven more than the product of 5 and a _____

(10) Twice the product of r and s _____

(11) The length of a side of a square that has a perimeter of p. feet _____

(12) The cost in dollars of R oranges at S¢ each _____

(13) The number of cents in D dimes and C cents _____

(14) The perimeter of a rectangle A" long and B" wide _____

(15) The number of dollars left after a man who had $ spends $B _____

TEST B

Grade VII May 31st.

Pupil's Name _____ Time _____ min.

Test B

Formulae and Equations

Give the formula for each of the following:

(1) area of a parallelogram _____

(2) area of a triangle _____

(3) area of a circle _____

(4) volume of a rectangular solid _____

Solve each of the following equations:

(5) $x + \frac{1}{2} = 6$ (6) $4w = 20$

(7) $x - 5 = 9$ (8) $\frac{a}{3} = 7$

Geometric Truths

(1) How does a rhombus differ from a parallelogram? _____

_____

(2) Two concentric circles have radii of 2" and $2\frac{1}{2}$". Compare their areas. _____

(3) How many circles may be drawn with the same centre? _____

(4) What kind of angle do the hands of a clock make at 5 p.m.?

_____

(5) Two angles of a triangle are 30 degrees and 65 degrees. What is the size of the third angle? _____

Problems

(1) A box is x" long, y" wide, and Z deep. Find its volume in cubic feet _____

(2) If a grocer paid x¢ a doz. for eggs and sold them at a loss of 3¢ a doz, how much would he receive for 2 doz. eggs? _____

(3) D dimes - _____ dollars

(4) n hours - _____ minutes.

(5) $\frac{x}{2}$ in. - _____ ft.

A

(6) A circular plot of ground is drawn to scale, the scale being $\frac{1}{4}$" to 100 ft. The circumference of the field is 2200 ft. Draw a scale the plan of the plot of ground. Do your drawing in the space to the right, under the letter A.

In the spaces below make a construction called for. Show all construction lines. (Use compasses and straight edge only.)

(7) Draw a perpendicular to the line segment AB at C

A B

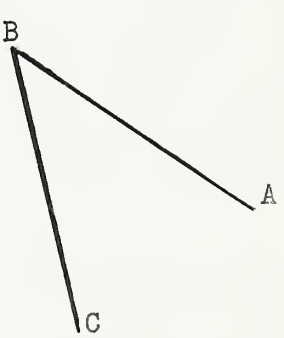
(8) Draw a line CD parallel to AB.

A B

(9) Bisect the straight line AB.

A B

(10) Bisect the angle ABC



LAZERTE'S SURVEY TEST ARITHMETIC TEST A Possible Score 74

Grade VIII May 31st. Pupil's score Test A _____

Pupil's Name _____ Sex _____

Age _____yr. _____mo. _____Time (Spelling and copying of items included). Test A __min.

Name of school _____Date_____

Test A

Spelling: Write the words that are dictated to you in the following spaces

1. _____ 7. _____ 13. _____
2. _____ 8. _____ 14. _____
3. _____ 9. _____ 15. _____
4. _____ 10. _____ 16. _____
5. _____ 11. _____
6. _____ 12. _____

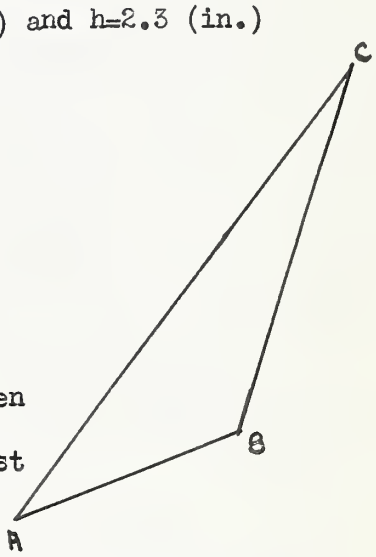
Formulas:

(1) Using the formula A = bh find A when b=4.8 (in) and h=2.3 (in.)

(2) Use the formula $A=\frac{1}{2}bh$ to find the area of the triangle ABC drawn to the right. Make all measurements in millimeters.

(a) take AC as base, (b) take BC as base

(c) take AB as base. Find the area by each of the three sets of measurements and then take the average computed area as your best approximation.



(3) Write the formula for the number of tons of coal (T) which will be held by a bin L ft. long, W ft. wide and H ft. high, if one ton of coal accupies 38 cu. ft. _____

(4) Write the formula for the total cost (C) of n pounds of butter at x¢ per pound and r dozen eggs at y¢ per doz. _____

Equations:

Solve the following equations:

(1) $8d - d + 5d = 84$ (2) $9.8w - 2.2w = 3.8$

(3) $4b - 12 = 24$ (4) $\frac{a}{2} + 6 = 14.$

(5) $\frac{c}{2} + \frac{3}{4} = 2$ (6) $3x + 7 + 6x = 97.$

Form the equations to express the following statements:

(7) 8 more than 5 times x equals 43. _____

(8) The sum of n and 15 is 37. _____

(9) The sum of twice x and three times y is 49. _____

-2- (Grade VIII, Test A, May 31st.)

Equations: (Cont.)

(10) Charles weighs 1.2 times as much as Edward. The sum of their weights is 165 pounds. _____

(11) The sides of a parallelogram meadure 3c and 5c inches respectively. The perimeter is 80 inches. _____

Powers and Roots:

(1) Write all the factors of 7^2, of 8^3 and of 14^2. _____

_____ _____

(2) 15^2 = _____ (3) 22^2 = _____

(4) $\sqrt{}$ 144 (5) $\sqrt{}$ 5329 = _____

(6) By the method of division and averaging, find the approximate square root of 1750. Check the result.

(7) Partial table of Squares.

No.	Square	No.	Square	No.	Square
21	441	46	2116	77	5929
22	484	47	2209	78	6084
23	529	48	2304	79	6241
24	576	49	2401	80	6400
25	625	50	2500	81	6561

Use the above table to find the approximate square roots of:

(a) $\sqrt{}$ 6290 = _____ (b) $\sqrt{}$ 2182 = _____ (c) $\sqrt{}$ 555 = _____

Denominate Numbers:

(1) 7 cm. = _____mm. (2) 1 meter = _____cm.

(3) 1000 cm. = _____ meters (4) 100 meters = _____ yd.(Approx)

(5) 100 yd. = _____ meters (approx) (6) 1 cm. = _____ in. (approx)

(7) 1 mile a min. = _____ km. per hr. (approx.)

(8) Find the sum of 72 cm., 16 mm. and 4 Kilometers. _____

A Few Mathematical Truths:

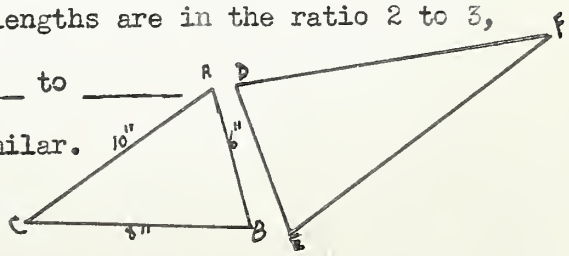
(1) The angles of a triangle are together equal to _____ degrees.

(2) One degree on the Centigrade Thermometer scale equals _____ degrees on the Fahrenheit scale.

(3) If the lengths of the sides of a right triangle are x ft. and y ft. then the length of the hypoteneuse is_____ft.

(4) If two squares have sides whose lengths are in the ratio 2 to 3, their areas are in the ratio _____ to _____

(5) The triangles ABC and DEF are similar. Name three pairs of equal angles.



- 3 - (Grade VIII, Test A, May 31st.)

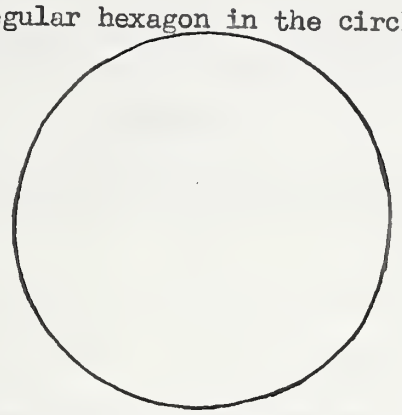
A Few Mathematical Truths: (Cont.)

(6) The lengths of AB, BC, CA and DE are marked in the figures.

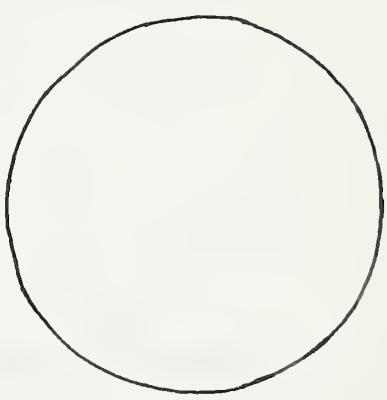
EF = _____ inches DF = _____ inches.

Constructions:

(1) Construct a regular hexagon in the circle below. Explain construction.



(2) Inscribe a square in the given circle. Explain the construction.



Problems:

(1) The area of a circle is $346\frac{1}{2}$ sq. ft. Find the length of the diameter.

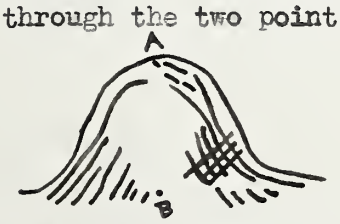
(2) If a window is 20ft. from the ground, how long must a ladder be in order to reach the window if the foot of the ladder is placed 7 ft. from the wall?_____

(3) If 6 quarts of alcohol were poured into a radiator containing 10 qts, of water, what would be the per cent of alcohol in the total mixture?_____

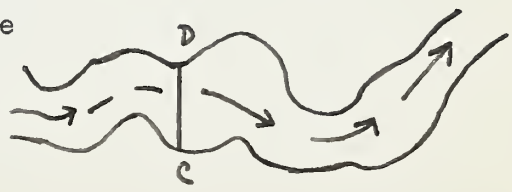
(4) A mixture of corn and wheat weighs 40 lb. If the mixture contained twice as many pounds of corn as wheat, find the weight of each.

_____

(5) Show how to use a scale drawing to find the height of the mound through the two points, A and B.



(6) Show how to measure indirectly the distance from C to D, points on opposite sides of a stream.



LAZERTE'S SURVEY TEST. MATHEMATICS Possible Score 100 _____

Grade IX Geometry May 15th Pupil's Score

Test A _____

Test B _____

Pupil's Name _____ Sex _____

Age _____yr _____mo. ____ Time_____

Name of School _____ Date_____

TEST A

Spelling: Write the words that are indicated to you in the following spaces:

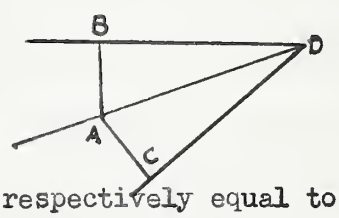
1. _____ 4. _____

2. _____ 5. _____

3. _____ 6. _____

Congruence:

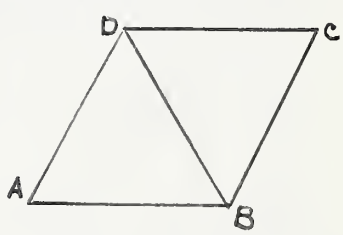
(1) DA bisects BDC and AB, AC are $\perp$ DB and DC respectively. That is:



_____, _____ and ____ are respectively equal to

_____, _____ and ____

(2) ABCD is a rhombus. DB is a diagonal.



$\therefore$ It is given that:

_____, _____ and ____ are respectively equal to _____, _____, and _____.

(3) ABC is a right triangle with the right angle at C. $\angle$ ACD is drawn equal to $\angle$ A, D being the point where the arm of the angle meets AB. Prove that CD is a median and that it is equal to $\frac{1}{2}$AB.

Construction:

Proof:

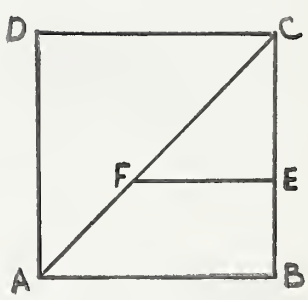
Inference:

(1) Write Yes or No in each blank.

	In all squares	In all rectangles	In all rhombuses	In all parallalograms
The diagonals bisect the angles				
The diagonals intersect at right angles.				
The diagonals bisect each other				
The diagonals are equal				

(2) The sides of a pentagon are 4,5,6,8 and 12 inches respectively. If the longest side of a similar polygon is 18 in.,find the lengths of the remaining sides, They are _____, _____, _____, and _____.

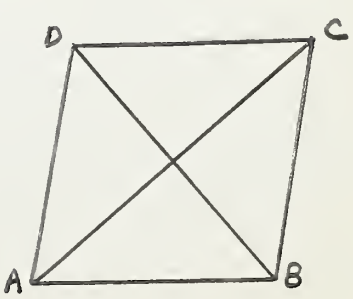
(3) ABCD is a 15" square. The diagonal is 21.21" long. If BE - 6" and FE // AB, what is the length of AF? _____.



(4) One side of a parallelogram is 10" long. The perimeter of the parallelogram is 50". Draw to scale three parallelograms with these dimensions to illustrate and prove your answer to this question: "Is the area of the parallelogram fixed and determinable?"

Language:

(1) Interpret the following in terms of the figure: "The sum of the squares on the diagonals of a rhombus is four times the square on any one of its sides."



- 3 - (Geometry Grade IX, May 15th.)

(2) Construct the figure for the following problem. (Figure only required.)

ABCD is a quadrilateral. Through D and B draw lines parallel to AC. Through A and C draw lines parallel to BD. Interpret in terms of the figure (but do not prove) that the resulting parallelogram is equal to twice the quadrilateral ABCD.

Draw and mark the dimensions of two polygons:

(3) that have corresponding sides proportional and are not similar.

(4) that have corresponding angles equal and are not similar;

(5) that have corresponding sides proportional and corresponding angles equal.

(6) Are similar triangles always congruent?_____

(7) Are all complementary angles equal?_____

(8) Are adjacent angles always acute?_____

(9) When is the exterior angle of a triangle acute?_____

_____

(10) In what case is the median of a triangle to the base also a right bisector?_____

_____

TEST B

Grade IX Geometry May 15th.

Pupil's Name _____ Time _____ min.

Symmetry:

How many axes of symmetry has a

(1) circle_____

(2) equilateral triangle_____

(3) isosceles triangle_____

(4) square_____

(5) rectangle?_____

Is there point symmetry in

(6) a circle_____ (7) a square_____

(8) an equilateral triangle_____ (9) a rectangle_____

Locus:

(1) What is the locus of the tip of the hour hand of a watch as the hand moves around the dial?_____

(2) What is the locus in space of points equidistant from two given points?_____

(3) What is the locus of points one foot from a given point.

(a) locus on a plane is_____

(b) locus in space is _____

(4) What is the locus of points within an angle equidistant from the sides of the angle?_____

(5) What is the locus of the center of a ball as it rolls on a straight line on a level floor?_____

(6) What is the locus of points equidistant from the top and bottom of this page?_____

Right-angled Triangle:

(1) The sides of a right-angled triangle are 15 ft. and 20ft. in length. What is the length of the hypotenuse?_____

(2) Each of the equal sides of an isosceles triangle is 50ft. and the base is 60 ft. Find the altitude._____

(3) Draw a straight line that is $\sqrt{2}$ inches long. Explain the construction.

Construction:

(1) Draw a line 3 inches long and divide it into four equal parts. (Use graduated ruler only when drawing the 3-inch line.)

(2) Construct a triangle equal in area to the given quadrilateral ABCD. Describe the construction.

Theorem

(1) Prove that parallelograms on the same base and between the same parallels are equal in area.

LAZERTE'S SURVEY TEST MATHEMATICS — Possible Score 110

Grade IX Algebra, May 15th — Pupil's Score _____

Pupil's Name _____ Sex _____

Age _____yr_____mo_____ Time (Spelling and copying of itmes included). _____min.

Name of School _____ Date _____

Spelling: Write the words that are dictated to you in the following spaces:

1. _____ 3. _____ 5. _____

2. _____ 4. _____ 6. _____

Signed Numbers:

Add:

(1) +6 + 3 = _____

(2) + 10 − 7 = _____

(3) − 4 + 8 = _____

(4) − 7 − 2 = _____

(5) − 3 − 6 = _____

(6) − 12 + 5 = _____

(7) + 4 −11 = _____

(8) + 12 − 8 − 9 + 3 = _____

Subtract:

(9) + 6 − 10 = _____

(10) − 15 + 6 = _____

(11) − 5 − 10 = _____

(12) − 12 − 4 = _____

(13) − 3 + 9 = _____

(14) + 14 − 3 = _____

(15) + 4 + 9 = _____

(16) + 11 + 10 = _____

(17) (+ 7) − (− 6) = _____

(18) (−8) − (−5) = _____

Multiply:

(19) (+6) x (−4) = _____

(20) (−9) x (+4) = _____

(21) (−3) x(−7) = _____

(22) (+7) x (+6) = _____

Divide:

(23) (−30) ÷ (−2) = _____

(24) (+16) ÷ (+4) = _____

(25) (−20) ÷ (+5) = _____

(26) (−60) ÷ (−10) = _____

(27) (−4) ÷ (−40) = _____

(28) (+2) ÷ (+8) = _____

(29) (+6) ÷ (−3) = _____

Computation:

(1) $(+16\ a^2) + (-15\ a^2) + (+4\ a^2)$ = _____

(2) Simplify: 4x − 6+8x+4 − 6x−9

(3) Remove brackets and combine like terms:

$8\ n^2 - (3n-2) + 2n\ (n-5)$ = _____

Computation: (Cont.)

(4) Remove brackets and combine like terms: $6y + 2y\ [3y-(4-2y)+5]$

(5) Add: $2x^2 - 5x+8$ and $-5x^2 - 8x+1$

(6) Subtract: $3a^3 - a^2 + 2a - 6$ from $a^3 - 7a^2 + 6a - 4$.

(7) $cr - (-5cr) =$ _____

(8) If $w = 3$ and $d = 2$, find the numerical value of
$5(w^2 d^2) - 5(-d^3) =$ _____

(9) $(-3a^3)(-4a^4)(+2b) =$ _____

(10) $(+a^2)(-a^2) =$ _____

(11) $(2x^2 y)^2 =$ _____

(12) $(5a^2 b^3)(-2a^2 b^2) =$ _____

(13) $4(3a^2 - 2b^2 - 5c^2) =$ _____

(14) $(4x^2 - xy+y^2)(-3x^2 y) =$ _____

(15) $(5y^{10} - y^2+3)(3y-4) =$ _____

(16) $a^3 \div a^5 =$ _____

(17) $(-12 r^4 s^2) \div (-4r^3 s^3)^4 =$ _____

(18) $\dfrac{8 m^2 n - 16m^2 n^2 + 12mn}{4mn} =$ _____

(19) Divide $4n^3 - 2n^2 p - 4np^2 - 16p^3$ by $2n - 4p$

(20) The volume of a rectangular solid is $5h^3 - 35h^2 + 60h$ cu.ft.

If its height is $5h$ ft., what is the area of its base?

Equations

(Solve) ;

(1) $7x+15 - x - 3 = 36$

(2) $7m - 4 = 13 + 5 - 3m$

(3) $3(3x+4) - 2(5x - 1) = 24$

(4) $\dfrac{c}{2} - \dfrac{5c}{8} + \dfrac{3c}{4} = 2\frac{1}{2}$

(5) $A = p + prt$. Find r. $r =$ _____

Problems:

(1) The sum of two numbers is 19. Four times the larger exceeds five times the smaller by 13. Find the numbers.

(2) Two sums of money are invested at 4% and 6% respectively. The second sum is $200. larger than the first The annual income from both investments is $92. Find each sum.

(3) Two trains start from the same place at the same time, travelling in opposite directions. One travels $2\frac{1}{2}$ times as fast as the other. They are 280 miles apart in 4 hours. Find the speed of each train.

(4) The altitude of a triangle exceeds the base by 4 inches. If the altitude is increased by 2 in. the area is increased by 10 sq. in. Find the base and the altitude.

CHAPTER III

KEYS

GRADE II

Score								
7	A.	8	7	86	89	669	878	17
7	B.	29	47	99	38	79	70	54
7	C.	79	60	78	48	58	70	69
3.	D.	30	56	90				
7.	E.	24	25	212	244	324	300	39
7	F.	37	55	43	76	50	34	54
7	G.	81	43	72	60	41	70	75
5	H.	57	75	64	45	71		

Part A - 2

Score		
1	1.	108
1	2.	60
1.	3.	140
1	4.	139
5	5.	80,90, 95,105,110
3	6.	120,130, 160
1	7.	20
1	8.	40
1	9.	six
1	10.	seven
1	11.	eight
1	12.	nine
1	13.	ten
1	14.	----
1	15.	----
1	16.	----
9	17.	32,34, 36, 38,40, 42,44, 46, 48.
1	18.	28
1	19.	20
1	20.	29
1	21.	8
1	22.	9

Part B (Second Sitting)

1	1.	Bill
1	2.	Tom
1	3.	4
1	4.	3
1	5.	6
1	6.	add
1	7.	---
1	8.	----
1	9.	C
1	10.	A
1	11.	D
1	12.	B

Part B - 2

1	1.	6.30(half past six) or 7.30
1	2.	a quarter to three
1.	3.	9:15 or 10:15
1	4.	6
1	5.	2
1	6.	6
1	7.	36

Part B - 3

2	1.	8¢
2	2.	17
2	3.	13¢
2	4.	12¢
2	5.	18
2	6.	5¢
2	7.	28
2	8.	29
2	9.	32
2	10.	5

KEY

Grade III May 31st.

Test A

Score Vocabulary (Spell from dictation)

	1. Half	6. Monday	11. even
	2. equal	7. Tuesday	12. remainder
	3. divide	8. product	13. quarter
	4. length	9. division	14. group
15.	5. weigh	10. quotient	15. minute

How to score

Acceptable answers given below. No partial credits to be given.
Spelling: 1 mark for each correctly spelled word.

Score Language

	1. pt.	5. hr.	9. sum
	2. qt.	6. yd.	10. product
	3. oz.	7. in.	11. quotient divided
12.	4. lb.	8. wk.	12. ounces two

Activities

3 marks if correct. Circle drawn with top of ink-bottle, marker etc.

3.

Denominate Numbers

(1) 2	(4) 12	(7) $1.80	(10) 87	(13) $\frac{1}{2}$
(2) 3	(5) 14	(8) 5	(11) 15	(14) $\frac{1}{3}$
(3) 16	(6) 5 qt. 1 pt.	(9) 4	(12) 3	(15) 2

15

Fractions

(1) $\frac{2}{4}$	(3) 5	(5) 20	(7) 6	(9) 90
(2) 4	(4) 5	(6) 18	(8) 30	(10) 28

10

Fundamentals - Add

(1) 231 (2) 176 (3) 1,301 (4) $12.12

4

Subtract

(1) 263 (2) 454 (3) $2.24 (4) $2.56

4

Multiply

(1) 48,936 (2) 92, 78. (3) 718,834.

(4) $5.34, $5.85 (5) 828, 1,072. (6) $12.28, $8.30.

12

Divide

(1) 24, 53. (2) 37, 360. (3) 23, 80. (4) 77, 238.

(5) 28 rem. 1 or $28\frac{1}{2}$, 98 rem. 1 or $98\frac{1}{5}$. (6) 21, 23.

(7) 93, 178 rem. 1 or $178\frac{1}{4}$. (8) 15, 81. (9) $124\frac{3}{5}$ or rem. 3, $74\frac{1}{5}$ or rem. 1. (10) $1.52\frac{3}{4}$ or rem. 3, $0.68 or $.68. Do not accept -1 or + 1 for remainder.

20

(over)

Test B

Score Generalizations

1. Multiply by 12.

2. Divide by 2.

3. Divide by 3.

12 4. Multiply by 7.

Problems

(1) 36 or 36 in.

(2) How many miles did I walk on both days?

(3) How much more money did we spend for ice cream than cake?

(4) $12. or $12.00

(5) 336

(6) $1.25

(7) 39

(8) 1

(9) 8¢

(10) 60¢ or cents or $.60

(11) $2.40

24 (12) $1.50

KEY

GRADE 1V May 31st.

Test A

Score

Spelling:

	1. average	7. degree	13. barley
	2. temperature	8. wheat	14. vegetables
	3. thermometer	9. square	15. bushel
	4. rectangle	10. rod	16. perimeter
18	5. section	11. statement	17. mile
	6. cash	12. sales	18. account

Language

1. By finding their total weight and dividing by 4. (Any answer that means this).

2. A line $1\frac{1}{4}$ inches long (Drawn).

3. By adding (or putting) two zeros on the right of the number. (Any statement that means this).

4. By dividing the number of quarts by 4. (Any statement that means this).

5. "A rectangle has 4 sides" should be underlined.

6 6. By multiplying the number of rods by $5\frac{1}{2}$. (Any statement that means this).

Denominate Numbers

	1. $2\frac{1}{2}$ quarts	8. 8 pecks	13. $\frac{5}{20}$ or $\frac{1}{4}$
	2. 90 seconds	9. $1\frac{1}{4}$ feet or $1\frac{3}{12}$ ft.	14. $6\frac{4}{6}$ or $6\frac{2}{3}$
	3. 48 hours	10. $6\frac{1}{2}$ quarts	15. $5\frac{1}{2}$
	4. 5 dozen	11. (a) 60 (b) 34 (c) 48	16. 320
	5. 14 inches		17. 1760
21	6. 56 ounces	(c) 12. $\frac{1}{4}$ or $\frac{4}{16}$	18. 67
for question 11.)	7. 3 gallons		19. 33

Fractions

	1. 3,2,4,6.	7. $\frac{1}{6}$	
	2. 7	8. 3 or $\frac{3}{6}$, or three sixths.	
	3. 12	9. $1\frac{1}{4}$	
15	4. 20	10. $5\frac{3}{4}$	
	5. $\frac{3}{9}$ or $\frac{1}{3}$	11. 6	
	6. $\frac{1}{4}$	12. $\frac{3}{6}$ or $\frac{1}{2}$	

Test B

Addition

	1. (a) 12,745	1. (b) 15,238
4	2. (a) $18.60	2. (b) $19.43

Subtraction

	1. (a) 2537	1. (b) 2424
4	2. (a) 4054	2. (b) 2343

(Over)

Score

Multiplication

1. 700
2. 2000
3. 620
4. 3260
5. 6310
6. 4800
7. (a) $327.95
   (b) $298.32

14

8. (a) 320
   (b) 5040
9. (a) 24150
   (b) 7680
10. (a) 21712
    (b) 18688

Division

1. (a) $800\frac{4}{7}$
   (b) $689\frac{4}{6}$ or $\frac{2}{3}$
2. (a) 8
   (b) 9
3. (a) 15
   (b) 60

10

4. (a) $14\frac{2}{40}$ or $\frac{1}{20}$
   (b) 13 $\frac{32}{60}$ or $\frac{8}{15}$
5. (a) $\$6.36\frac{2}{3}$ or $\frac{6}{9}$
   (b) $\$9.78\frac{2}{8}$ or $\frac{1}{4}$

Problems

1. 37 inches, or 3 feet 1 inch.
2. $1.10
3. $1.20
4. $2.20
5. Accept any answer between $2.70 to $3.10
6. Line must be $1\frac{1}{2}$ inches long.
7. 15 square feet.
8. Adding two times the length to two times the width or any answer which menas the same.
9. (a) 4 feet

2 each

   (b) 5 feet

24

10. 90c. or $.90
11. $7\frac{1}{2}$ miles.

---

12. (Name of Student) Mar. 20, 1940.

(Address)

SOLD TO Mrs. A. Brown.

3 lbs.	Bacon at 45c a lb.	1	35
4	Loaves bread at 10c each		40
2 lbs.	Butter at 23c a lb.		46
1 lb.	Tea at 48c a lb.		48
		2	69

KEY

GRADE V May 31st.

Test A

Marks

Spelling (from dictation)

	1. proper	7. height	13. like
	2. freezing	8. receipt	14. thermometer
16	3. temperature	9. numerator	15. recipe
	4. measure	10. boiling	16. decimal
	5. improper	11. weight	
	6. unlike	12. account	

Number System

7
1. 17.6
2. 10.1
3. 104.4
4. 2 hundreds, 9 units, 7 tenths, 6 hundredths.

Language

4
1. Either
2. Smaller
3. Either
4. Colder

Denominate Numbers

12
1. 68
2. 150
3. 90^0
4. 212^0 or 212 degrees
5. 2 inches
6. 1100
7. 55
8. 60 inches
9. 17
10. 1 yd. 1 ft. 2 in.

Fractions

4 1.

1 2. $\frac{7}{12}$

11 3. (a) $\frac{7}{8}, \frac{5}{6}, \frac{6}{7}, \frac{10}{11}, \frac{1}{7}, \frac{4}{9}$.

(b)(b) $\frac{9}{8}, \frac{11}{10}$.

(c) $2\frac{1}{4}, 10\frac{1}{11}, 5\frac{1}{4}$.

1 4. $2\frac{1}{6}$.

6 5. $2\frac{1}{6}, 1\frac{4}{5}, 2\frac{1}{8}, 2\frac{1}{5}, 5\frac{2}{5}, 7\frac{2}{7}$.

5 6. $\frac{3}{4}$. 7. $7\frac{1}{2}$

8. 9. 9. $7\frac{1}{9}$

10. $7\frac{4}{7}$

9 11. $6\frac{2}{3}$" X 4 $\frac{2}{3}$" or $6\frac{2}{3}$ inches long by $4\frac{2}{3}$ inches wide.

12. $1\frac{1}{4}$ 13. $1\frac{2}{9}$

14. $1\frac{1}{3}$ 15. $\frac{1}{10}$

16. $\frac{1}{8}$ 17. $1\frac{5}{12}$

18. $1\frac{7}{12}$ 19. $\frac{1}{6}$

TEST B

Addition

15
1. 2850, 3871
2. \$97.26, \$111.70
3. $7\frac{5}{8}$, $6\frac{7}{8}$
4. $5\frac{7}{9}$, $11\frac{1}{4}$
5. 6 ft. 3 in.
6. 7 yd. or 7yd. 0 ft.
7. 16 qt. 1 pt.
8. 16.4, 21.5
9. 9.25, 12.74.

Score

Subtraction

1. 146942, 258535 2. $187.15, $4535.58

8 3. 3.5, 4.0 or 4 4. 12.8, 0.6 or .6

Multiplication

1. 16704, 27028 2. 153293, 248688

6

5. $4406.72, $24716.70

Division

1. 8, 8 2. $9\frac{20}{30}$, $7\frac{20}{50}$

3. $8\frac{18}{21}$, $8\frac{22}{41}$ 4. $19\frac{13}{23}$, $8\frac{44}{82}$

5. $8\frac{74}{75}$, $8\frac{23}{46}$ 6. $8\frac{8}{69}$, $7\frac{66}{78}$

14 7. $70\frac{213}{436}$, $110\frac{115}{278}$

TEST C

Problems

1. $9\frac{1}{4}$ books or $9\frac{1}{4}$ 8. The value is the same.

2. $35.75; or 65 books at 55¢; $1.75 9. $\frac{20}{50}$ or $\frac{2}{5}$

34 To problems 1 to 10 give credit of 3 each. Credit of 1 for othres.

3. $14\frac{1}{4}$ or $14\frac{1}{4}$ inches 10. 1280

4. $15\frac{21}{48}$ hr. or $15\frac{7}{16}$ hr. 11. $17.50

5. 1" represents 100 miles 12. $1.60

6. $28.40 13. 1200

7. Girls; .49 or 49¢ 14. $1\frac{1}{2}$¢

KEY

Grade VI May 31st.

Test A

Score

Vocabulary: (Score one mark for each word correct)

	complex	percentage	section
12	decimal	volume	angle
	hundredth	cube	compasses
	degree	longitude	column

Number System

1 1. Two tenths or one fifth
1 2. 1.2
1 3. 2 squares
1 4. 10 squares
1 5. 14 squares
1 6. 15.024
1 7. 10.7 ft.

Language

1 1. $\frac{1}{25}$

1 2. Divide the volume in cu. in. by 1728

1 3. 200

2 4. (a) township (b) 11 sections or 44 quarter sections

Denominate Numbers

Score		Score	
1	1. 1728 cu. in.	1	2. 27 cu. ft.
1	3. $16\frac{1}{2}$ ft.	1	4. 30 $\frac{1}{4}$ sq. yd.
1	5. 90 degrees	1	6. 80 degrees

Common Fractions

1	1. $\frac{7}{10}$	1	2. $1\frac{9}{13}$
1	3. $\frac{1}{3}$	1	4. $1\frac{1}{2}$
1	5. $\frac{21}{5}$	3	6. $\frac{6}{7}$, $\frac{5}{7}$, $\frac{7}{11}$,
1	7. $\frac{1}{3}$	1	8. $\frac{9}{14}$

Decimals and Decimal Fractions

3 1. $3\frac{3}{5}$, $2\frac{1}{4}$, $4\frac{3}{100}$

3 2. 2.2, 0.14, 0.08

2 3. (a) 39.04 (b) 4.56

2 (c) 0.63 (d) 0.4015

2 (e) 1.104 (f) 62.

1 4. 1208.2

Test B

Score

1 Add

1 1. 33.62

1 2. $3447.04

1 3. 22 hr. 31 min.

1 4. $22\frac{5}{12}$

1 5. $12\frac{1}{10}$

1 6. 84.91

1 7. 25 mi. 240 rds.

1 8. $2\frac{13}{24}$

Score		Score		Score	
	Subtract				
1	1. 1707346	1	2. 4 gal. 2 qt.	1	3. 6 acres, 105 sq. rd.
1	4. $\frac{3}{8}$	1	5. $\frac{1}{14}$	1	6. $11\frac{7}{12}$
1	7. $1\frac{11}{15}$	1	8. 35.44	1	9. 30.68
1	10. 57.463				
	Multiply				
1	1. 41912	1	2. 161986	1	3. 46cwt. 86 lb.
1	4. $2\frac{1}{3}$	1	5. $7\frac{14}{25}$	1	6. 1
1	7. 28.9	1	8. 4.992	1	9. 0.0323
	Divide				
1	1. $253\frac{14}{38}$ or $253\frac{7}{19}$	1	2. $384\frac{309}{563}$	1	3. 3
1	4. 6	1	5. 0.838	1	6. 0.59
1	7. 0.22	1	8. 2 gal $\frac{1}{2}$ qt.		

Test C

Graph

2 (1) Montreal 200 ft. North Bay 700 ft.

2 Saskatoon 1600 ft. Edmonton 2200 ft.

1 Jasper 3450 ft.

(2) Teacher checks pupil's work.

(3) Approximations

2 Ottawa 200 ft. Winnipeg 800 ft.

2 Regina 1900 ft. Calgary 3400 ft.

1 Banff 4500 ft.

Problems

3 1. $\frac{6}{7}$

3 2. 43¢ ($42\frac{6}{7}$¢)

3 3. $3\frac{1}{8}$ cu. ft.

3. 4. 106.05 ft.

3 5. (a) 4.5 in.

3 (b) 86.0625 lb.

3 6. $38.50

3 7. 3 P.M.

3 8. $2\frac{37}{40}$

3 9. 70%

3 10. $66\frac{2}{3}$%

KEY

Grade VII, May 31st.

Score

Spelling: (from dictation).

	1. geometry	10. concentric	18. vertices	26. horizontal
	2. figure	11. diameter	19. arc	27. transversal
	3. angle	12. radii	20. protractor	28. perpendicular
	4. acute	13. dividers	21. transit	29. parallel
1 for	5. obtuse	14. vertex	22. vertical	30. oblique
	6. rhombus	15. bisector	23. isocles	31. scalene
each	7. altitude	16. estimate	24. algebra	32. standard
	8. formula	17. insurance	25. premium	33. interest
33	9. principal			

Question 1 Graph. Use of instruments to be allowed for this question. Protractor, ruler, etc.
" 2 " Marks, 1 for each part right. 5 possible.
" 2 " Accept approximate markings on graph within the correct square above or below the half way point. 12 marks.
Must be complete or no marks.

Sheet 2.

Question 1. 1 mark
2. 1 mark
3. 1 mark for each fact. Toetal 8

Language 1 - 15. 1 mark for each part. Tetal 15.

Sheet 3. Test B.

Formulae and equations: 1 mark each. Total 8
Geometric truths; 1 mark each. Total 8
Problems: 1 mark each. Total 5

Sheet 4. 2 marks each. Total 10.

Answers.

Sheet 1.

1. 3 degrees per million dollars on graph.
Check with protractor.

2. See teachers' directions.

Sheet 2.

Interest and Insurance

1. $12. 2. $11.20

3.	Prin.	Rate	Time	Interest	Amount
	---	----	----	$102.00	$952.00
	---	$2\frac{1}{2}\%$	----	-------	12.90
	$800.	-----	----	-------	900.00
	$200.	4%	----	-------	------

Language

1. $2a + 3b + 5c$ 3. $2yz$ 5. $x=y+1$ or $x-1=y$
2

2. $2x - 3y$ 4. $\frac{12x}{5y}$ 6. 10n

7. $\frac{a+b}{2}$ or $\frac{1}{2}(a+b)$ 8. $6ab - 4$ 9. $5a + 7$

Language

10. 2 rs. 11. $\frac{P}{4}$ or $\frac{1}{4}$ P 12. $\$ \frac{rs}{100}$

13. (10d + c) cents 14. 2(a+b)in or (2a+2b) in. 15. $(a-b) or (a-b) dollars.

Sheet 3.

Formulae and Equations. All these expressions must be written out completely as shown.

1. $A = ba$ or $A = bh$
2. $A = \frac{ba}{2}$ or $A = \frac{1}{2}ab$
3. $A = \pi r^2$
4. $V = lwh$
5. $x = 5\frac{1}{2}$
6. $W = 5$
7. $x = 14$
8. $A = 21$

Geometric Truths

1. Pupil must bring out the idea that a rhombus has four equal sides while a parallelogram has opposite sides equal and parallel.
2. The inner or smaller circle is $\frac{16}{25}$ of outer or larger circle. Or; Inner or smaller circle is $7\frac{1}{14}$ sq. in. less than outer circle or the reverse of this answer.
3. N circles, or any number of circles.
4. An obtuse angle.
5. 85 or 86 degrees or 85^{o}.

Problems:

1. $\frac{\sqrt{xyz}}{1728}$ cu. ft. 2. 2(x-3) cents
3. $\frac{D}{10}$ dollars 4. 60 minutes
5. $\frac{x}{24}$ ft.

Sheet 4.

6. Radius of circle $\frac{7}{8}$ in. Circle must be accurate.
7. 8.910. See text book for correct constructio form.

KEY

GRADE VIII MAY 31st

Test A

Score

(Spelling from dictation)

Dictate the words, explain each one or use it in a sentence.

Dictate the words again.

1. algebra	7. adjacent	13. similar
2. dimension	8. hexagon	14. proportional
16	3. congruent	9. octagon	15. meter
4. root	10. exponent	16. millimeter
5. metric	11. kilometer	
6. centimeter	12. polygon	

Formulas:

1 (1) A = 11.04 sq.in.

1 (2) 76 mm base 684)
52 mm base 676) Average 677 (approx.)
32 mm base 672)

1 (3) $T = \frac{L\ w\ h}{38}$

1 (4) C = nx¢ + ry¢

Equations:

(1) d = 7 (2) w = $\frac{1}{2}$ or 0.5

(3) b = 9 (4) a = 16

11 (5) c = $2\frac{1}{2}$ (6) x = 10

(7) 5x + 8 = 43 (8) n + 15 = 37

(9) 2x - 3y = 49 (10) x + 1.2x = 165 lbs.

(10) 2(3c - 5c) = 80

Powers and Roots:

(1) 7 x 7 8 x 8 x 8 14 x 14
(2 x4) x (2 x 4) x (2 x 4) (7x2) x (7x2)
9 (2 x2x2) x (2x2x2) x (2x2x2)

(2) 225 (3) 484

(4) 12 (5) 73

(6) 42 (approx.) (7) (a) 79.7 (b) 46.7 (c) 23.5

Denominate Numbers:

(1) 70 mm. (2) 100 cm.

(2) 10 meters (4) 109 yd. (approx,)

8 (5) 100 yd. = 92 meters (approx.) (6) 1cm.= .4 in.(approx)

(7) 1 mile per min.= 96 km. per hr. (approx.)

(8) 4,000,736 mm.

A Few Mathematical Truths:

(1) 180 degrees

6 (2) $\frac{9}{5}$ C + 32

(3) $\sqrt{x^2 + y^2}$

(4) 4 to 9

Score

A Few Mathematical Truths (cont.)

(5) C and F or ACB = DFE
A and D or CAB = EDF
B and E or ABC = DEF

(6) EF = 12 inches DF = 15 inches

Constructions:

(1) Accept either solution.
Draw radius of the circle. Measure radius. From the
1 point where the radius touches the circumference, mark off an arc equal in length to the radius. Continue this method around the circle. Join these points in succession. The figure is the required hexagon.

OR

Draw radius of the circle. At the centre of the circle construct 6 angles of 60 degrees each. Join the points where the arms of these angles touch the circumference. This is the required hexagon.

(2) Draw the diameter of the circle. Draw another
1 diameter $\perp$ r to the first one.
Connect the ends of the diameters in succession.

Problems:

(1) 21 ft.

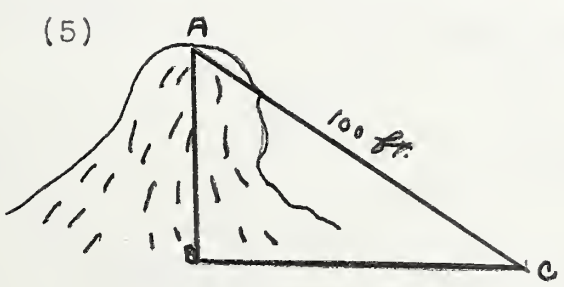
(2) 21.19 ft.

18 (3) $37\frac{1}{2}\%$

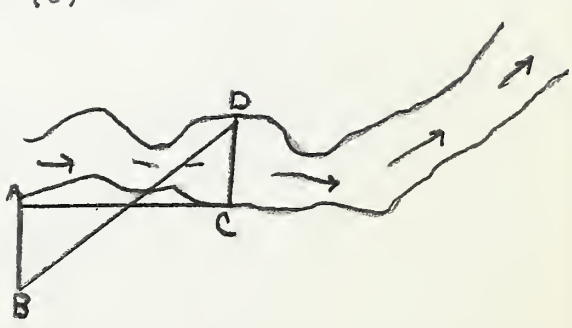
(4) wheat $13\frac{1}{3}$ lbs.

corn $26\frac{2}{3}$ lbs.

(5)



(6)



KEY

GRADE IX GEOMETRY May15th

Test A

Score

Spelling: Dictate the words for spelling:

	quadrilateral	parallelogram
6	rhombus	similarity
	trapezium	symmetry

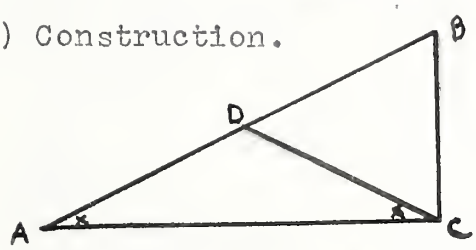
Congruence:

3 (1) AD, BDA and ABD = AD, CDA and ACD

3 (2) AD, AB and DB = CD, CB and DB or CB, CD and DB.

(3) Construction.

(2 -5)
7



Suggested Proof:

$\angle A = \angle ACD$ ... Const.

$\therefore DA = DC$ ... Theorem 16

$\angle A + \angle B = 90$ degrees

$\angle ACD + \angle BCD = 90$ degrees

$\because \angle A = \angle ACD$.

($\therefore \angle A + \angle B = \angle ACD + \angle BCD$

$\therefore \angle B = \angle BCD$ and $DC = DB$ ... Theorem 16

$\therefore DA = DC = DB$ and D is the mid-point of AB

$\therefore$ DC is a median.

Also $DC = \frac{1}{2}(AD + DB) = \frac{1}{2} AB$

Inferences:

(1) Yes, No, Yes, No.

Yes, No, Yes, No.

$16 \times \frac{1}{4} = 4$

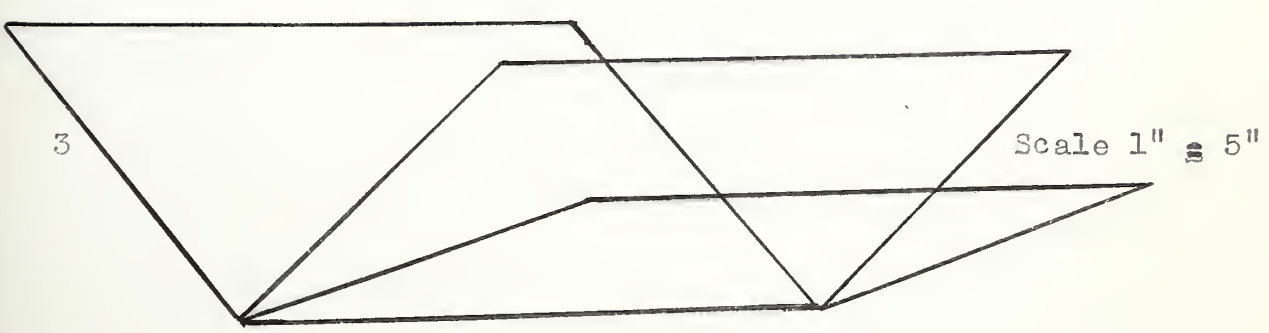
Yes, Yes, Yes, Yes.

Yes, Yes, No, No.

4 (2) 6 in., $7\frac{1}{2}$ in., 9 in. and 12 in. (insist on units in answer.)

4 (3) 8.48" . (Accept 8.4 or 8.5)

1 (4) Suggested Construction. No.



3

Scale 1" = 5"

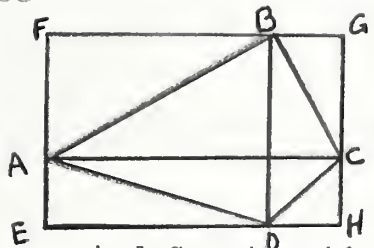
Score

Language:

3 (1) $AC^2 + DB^2 = 4\ AB^2$

(2-2) (2) Suggested Construction.

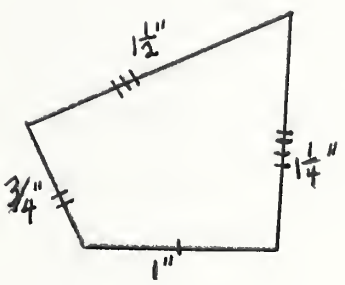
4

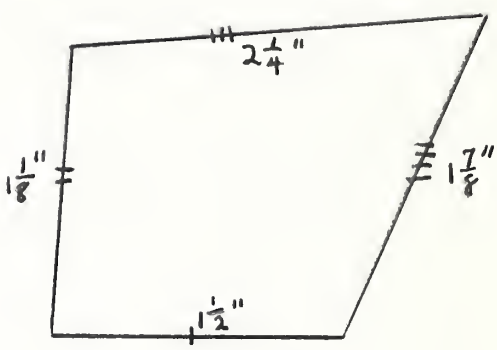


ll gm.EFGH = 2 quad.ABCD

(3) Suggested Construction.

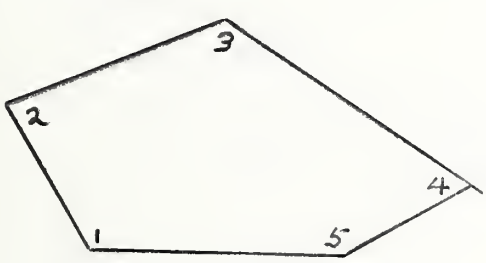
3

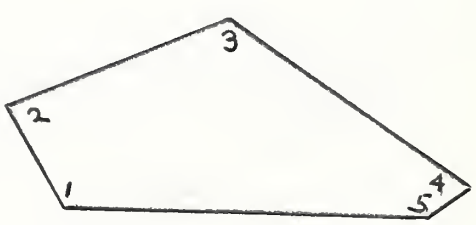




(4) Suggested Construction.

3





2 (5) Any two similar polygons of 3 or more sides

1 (6) No.

1 (7) No.

1 (8) No.

1 (9) When the interior angle is obtuse

1 (10) An isosceles triangle.

55

KEY

GRADE IX GEOMETRY MAY 15th

TEST B

Score

Symmetry:

1 (1) Unlimited -- Any diameter.

1 (2) 3.

1 (3) 1.

1 (4) 4.

1 (5) 2.

1 (6) Yes.

1 (7) Yes.

1 (8) No.

1 (9) Yes.

Locus:

1 (1) Circle

2 (2) The plane which bisects at right angles the straight line joining the two points.

2x1=2 (3) (a) A circle . (b) A sphere.

1 (4) Bisector of the angle.

1 (5) Straight line parallel to the straight line on the floor.

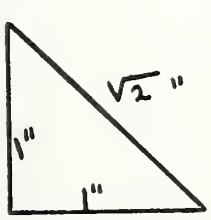
1 (6) A line parallel to the top or bottom half-way between.

Right-angled Triangle:

3 (1) 25 ft.

3 (2) 40 ft.

3 (3)



Construction:

3 (1) Use method of Construction 7

6 (2) Use method of Construction 8

10 (3) Theorem 21

KEY

Grade IX Algebra, May 15th.

Score

Spelling: Instruct the pupils to write the following words in the spaces provided as they are dictated.

1 each 6

1. Monomial
2. binomial
3. trinomial
4. polynomial
5. literal
6. expenent

Signed Numbers:

Add: (1) 9 (2) 3 (3) 4 (4) -9

6 (5) -9 (6) -7 (7) -7 (8) -2

Subtract:

(9) 16 (10) -21 (11) 5 (12) -8

10 (13) -12 (14) 17 (15) -5 (16) 1

(17) 13 (18) -3

Multiply:

4 (19) -24 (20) -36 (21) 21 (22) 42

Divide:

(23) 15 (24) 4 (25) -4 (26) 6

(27) $\frac{1}{10}$ (28) $\frac{1}{4}$ (29) -2

Computations:

Score

2 (1) $5a^2$

2 (2) $6x - 11$

3 (3) $10n^2 - 13n + 2$

3 (4) $10y^2 - 8y$

2 (5) $-3x^2 - 13x + 9$

2 (6) $2a^3 + 6a^2 - 4a - 2$

1 (7) $6cr$

2 (8) 1580

2 (9) $24a^2b$

1 (10) a^9

1 (11) $4x^4y^2$

2 (12) $-10a^4b^4$

1 (13) $12a - 8b - 20c$

2 (14) $-12x^4y + 3x^3y^2 - 3x^2y^3$

3 (15) $15y^3 - 23y + 13y - 12$

1 (16) a^8

2 (17) $3rs^4$

2 (18) $2n^3 - 4m^2n + 3n^2$

3 (19) $2n^2 + 3np + 4p^2$

2 (20) $(h^2 - 7h + 12)$ sq. ft.

Equations:

3 each 15

(1) X = 4 (2) m = -3 (3) X = -10

(4) c = 4 (5) $\frac{A - p}{pt} = R$

KEY

Grade IX Algebra, May 15. (cont. -2)

Score

20

(5 each)

Problems:

(1) Larger number is 12
Smaller number is 7

(2) One sum is $800. The other sum is $1000.

(3) One train goes 20 miles per hour. The other train goes 50 miles per hour.

(4) The base is 10 in. The altitude is 14 in.

CHAPTER IV

GRADE II

Grade II made the highest average in the tests. The total possible score was 125; the average score established by 200 students in this test was 85.75 or 68.6%.

The median was 88.

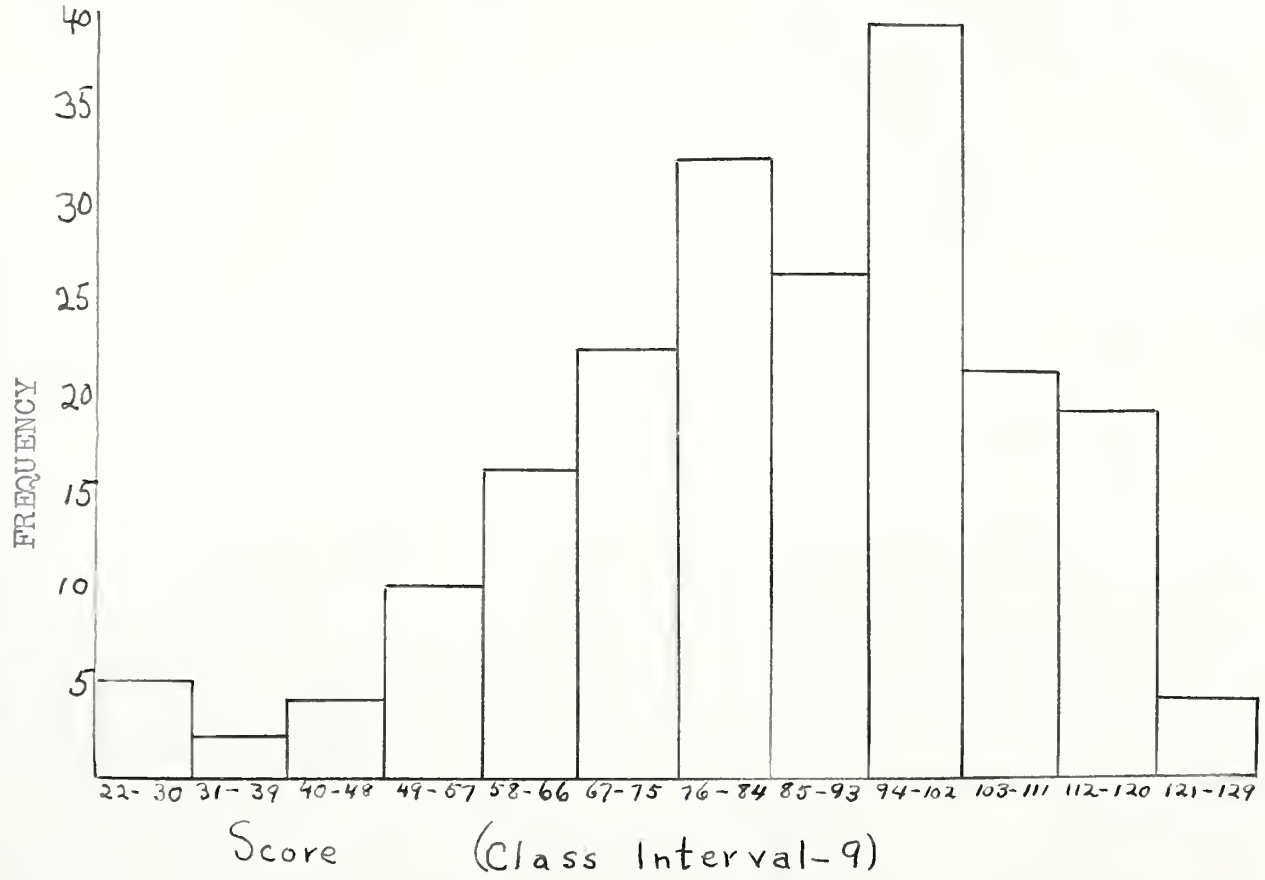
75% of the pupils scored over 73.

25% of the pupils scored over 110.

TABLE I

FREQUENCY DISTRIBUTION OF TOTAL SCORES

No.of Cases	Score	No.of Cases	Score	No.of Cases	Score	No.of Cases	Score	No.of Cases	Score
1	22	2	60	6	75	3	91	1	107
1	23	2	61	5	76	3	92	2	108
2	25	1	62	1	77	3	93	3	109
1	27	2	63	2	78	5	95	2	110
1	34	5	64	5	79	5	96	2	111
1	37	2	65	4	80	5	97	2	112
2	43	1	66	4	81	3	98	1	113
1	45	3	67	3	82	6	99	6	114
1	47	2	68	4	83	6	100	2	115
2	51	1	69	4	84	6	101	5	116
2	52	2	70	2	85	3	102	2	117
2	54	1	71	1	86	6	103	1	120
3	56	2	72	3	87	2	104	1	121
1	57	2	73	5	88	1	105	1	122
1	58	3	74	6	89	2	106	2	124



Class	Frequency
22-30	5
31-39	2
40-48	4
49-57	10
58-66	16
67-75	22
76-84	32
85-93	26
94-102	39
103-111	21
112-120	19
121-129	4
Total	200

Fig. 1. – Frequency distribution of total score

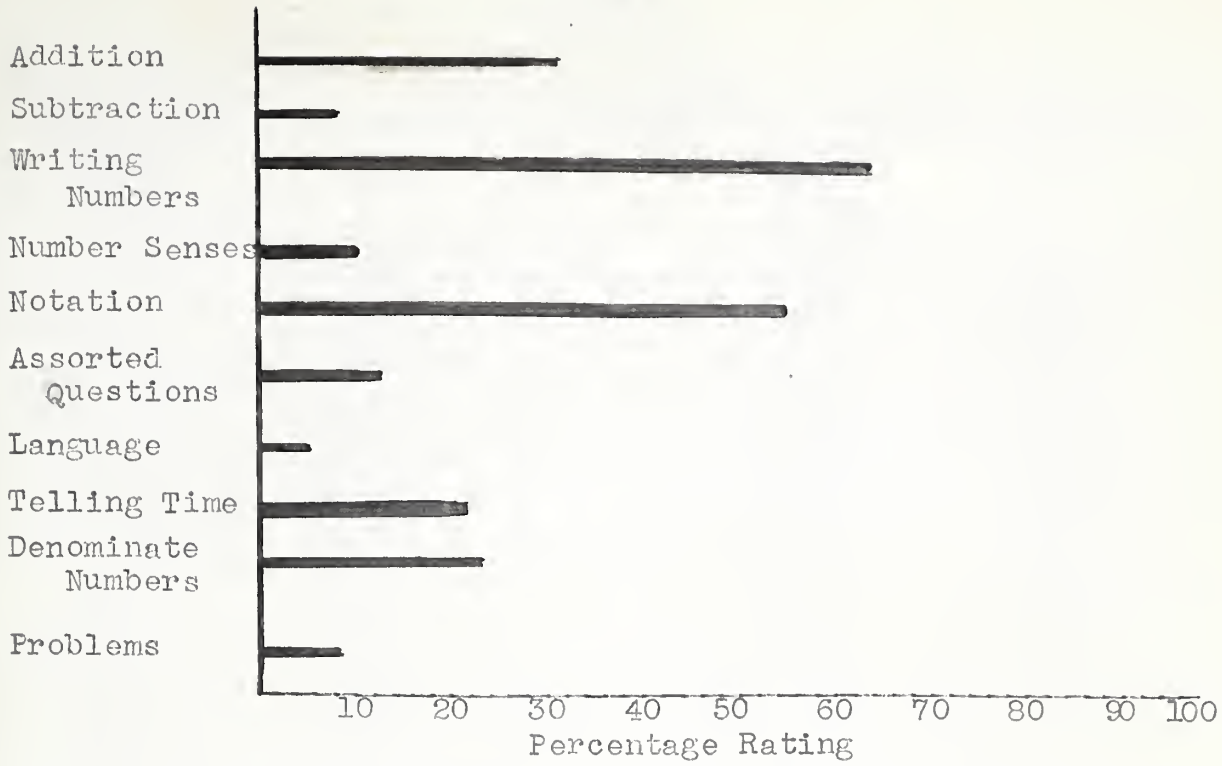


Fig. 2.- Percentage of answers scored correct in each section of the Grade II test.

TABLE II

NORMS FOR EACH SECTION OF THE GRADE II TEST PAPER

	Possible Score on Test	75% of Pupils Scored above	50% of Pupils Scored above	25% of Pupils Scored above
Addition	24	18	21	23
Subtraction	26	14	19	21
Writing Nos.	4	2	3	3
Number Senses	10	2	6	8
Notation	5	4	7	14
Assorted	17	4	7	14
Language	12	6	8	9
Telling Time	3	0	1	2
Denominate Nos.	4	0	2	3
Problems	20	9	12	16
Total	125	73	87	110

TABLE III

CLASSIFICATION OF SCORES BY AGE GROUPS AND SEXES (GRADE II)

Age Groups (years)	SEX	No.	Average Age (months)	Average Score
7 - 7½	Boys	10	84.5	86.3
	Girls	11	84.9	90.7
7½ - 8	Boys	5	94.	75.2
	Girls	8	92.5	77.9
8 - 8½	Boys	24	97.	93.1
	Girls	45	97.7	84.1
8½ - 9	Boys	13	1048	84.7
	Girls	17	104.5	86.5
9 - 9½	Boys	16	110.7	85.3
	Girls	17	108.9	81.1
9½ - 10	Boys	2	118.	79.5
	Girls	7	116.8	88.5
10 - 10½	Boys	9	122.1	84.7
	Girls	8	123.4	78.7
10½ - 11	Boys	0	--	--
	Girls	1	127.	37.0
11 - 11½	Boys	0	--	--
	Girls	1	132.	103.0

In three age classes the boys are higher; the difference is larger than in the classes where the girls excel. It is significant that the youngest age group made high schres comparatively. This does not indicate that maturity of experience is a weighty factor in comprehending arithmetic. It appears that these youngest children do as well, if not better , than many of the older ones. It may be suggested that child of ten years in Grade II is backward; but there were children of ten years or more who made scores of 96 - 111. There was one case of a score of 25 in this age class. In the first case it was likely lack of opportunity rather than lack of capacity. But maturation has not made a significant showing either, as children of seven years made higher scores, one making 116.

TABLE IV

TOTAL GROUP CLASSIFICATION BY SEX

	No.	Total Aggregate	Average Age	Average Score
Boys	83	7418	8.15 yrs.	89.27
Girls	117	9732	8.47 yrs.	83.18

Over the total group the average score of the boys was 6.09 marks higher than that of the girls; the average age was slightly less.

TABLE V

	Mark Allowed	Total Possible Aggregate	Total Actual Aggregate	Average Mark Score	Average Mark %
Addition	24	4800	4076	20.38	84.91
Subtraction	26	5200	3542	17.71	68.11
Writing Nos.	4	800	655	3.27	81.75
Number Senses	10	2000	1168	5.84	58.4
Notation	5	1000	863	4.31	86.2
Assorted Questions	17	3400	1914	9.57	56.2
Language	12	2400	1658	8.29	69.08
Telling Time	3	600	291	1.45	48.33
Denominate Nos.	4	800	464	2.32	58.0
Problems	20	4000	2519	12.59	62.45

The table above indicates the possible scores and aggregates as well as the actual aggregates and arithmetic means established by 200 students for each of the ten sections of the Grade II test.

ADDITION

24 questions with an allowance of 1 mark each comprised this section of the test. The addition yielded the highest average score on the test. The average score was 84.9%.

No one scored zero, though 2 students received a score of 3. 63 pupils got all the questions correct.

A diagnostic test aims to reveal the nature of the errors made. It is impossible to find all the types of difficulties such as shifting around or counting as might be revealed by verbal statements. Nevertheless many types of errors were revealed.

Description of difficulties:

The greatest difficulty arose in two column addition where carrying was involved; for example only the first type of error occurred in the first six questions on addition.

Types:

1. Incorrect Combinations.

4	5
5	4
8	2
	12

This was the most common type of error; 28% showed weakness in combinations.

2. Failure to carry to the tens column.

59	62
1	8
510	610

Here the pupil continued his practise of one column addition and wrote down the answer to the first column and then went on to the next column and wrote down the left hand number. 32 pupils showed this inability to make the bridge from addition of one column to two columns.

3. Adds all the numbers together.

34	56
4	2
11	13

9 students, failing to understand two column addition, added the left hand digit in the upper number to the sum of the right hand digits. Nearly all the addition questions on their papers were consequently wrong. The remedy lies in learning the new processes involved in two column addition.

4. Adds only the right hand column.

23	33
7	3
10	6

This type is closely associated with the third type above, except that the left hand digit is ignored altogether. 6% of the pupils made this mistake, but as in question 3 type, nearly all the problems involving carrying were wrong.

5. Adds 1 to the second column.

34	72
4	7
48	89

This error occurred once ; but it indicates the difficulty for children to learn two column addition. This child has remembered that one writes down one digit of the sum of the first combination and 'carries' the other, and he has apparently acquired the idea that one must always carry 1 in addition of more than one column.

6. Adds the bottom number to each digit of the top number.

75	83
4	7
119	160

2 pupils made this mistake ; but the difficulty of transferring from one column to two column addition is again shown. The second example is interesting, for the pupil carried the 1 from his first combination to add with the 8, but he also added the 7 again.

7. Adds all the digits for the second combination.

26
3
119

The pupil added 3 and 6 and wrote 9; then he added all the figures to get the 11. This is again another example of the failure to comprehend the processes involved in two column addition.

8. Difficulty in bridging tens.

62	59
8	1
80	70

This type of error shown by 7 pupils occurred only where the right hand digit of the first combination ended in zero.

9. Inversed the digits;- second combination on the wrong side.

59	13
1	4
06	71

The three examples of this type may not be evidence of lack of knowledge; but it would appear that the students had added 1 and 9 and written down the 0 and carried the 1 to add with the 5 and placed the second combination on the right hand side of the first digit in the answer.

10. Subtracted.

66
3
63

6 students made this mistake.

11. Failure to carry.

65
5
60

11 students gave this variation of the failure to comprehend two column addition. These students understood the writing down of only the zero from the first combination, but failed to carry the 1. The examples were all in cases of the first combination being 10.

12. Failure to carry to the tens column and inversion of digits.

65	62
5	8
106	106

Here again the students do not understand the two column addition. These students added the right hand digits and wrote down the sum without regard for the 'carrying process'. Then they wrote down the other digit in the answer on the wrong side of the first sum.

SUBTRACTION

The average score for the 26 questions in subtraction was 68.1%. Only 16 pupils did all the questions correctly.

Subtraction represented the hardest skill on the test; it is important that an analysis of skills required in subtraction be understood andthat errors be diagnosed to determine the child's knowledge of the facts required.

The nature of each error having been determined, a set of exercises should be designed to follow careful instruction in the particular skill required.

Difficulties:

The most common error lay in the lack of knowledge of combinations or else in the failure to understand what was wanted; many students added, although many added in the subtraction exercises only where no minus sign was shown.

Types of Errors:

1. Weakness in Combinations:

$$\begin{array}{r} 78 \\ \underline{53} \\ 24 \end{array}$$

53 students lacked knowledge of subtraction combinations.

2. Addition instead of subtraction.

$$\begin{array}{r} 500 \\ \underline{200} \\ 700 \end{array}$$

This was the most common error; 66 out of the 200 students added the examples.

One variation of the addition was represented by adding the digits of the minuend and then subtracting the subtrahend.

$$\begin{array}{rr} 46 & 58 \\ -3 & -4 \\ \hline 7 & 9 \end{array}$$

3. Subtraction of the subtrahend from the right hand digit of the minuend only.

$$\begin{array}{r} 46 \\ \underline{-3} \\ 3 \end{array}$$

13 pupils showed this fault.

4. Subtraction of subtrahend from each digit of the minuend.

$$\begin{array}{r} 39 \\ -2 \\ \hline 17 \end{array}$$

Here again 5 students indicated their inability to deal with 2 digit numbers in subtraction.

5. Borrowing difficulties

(a) Borrowing when it was unnecessary

$$\begin{array}{r} 86 \\ -5 \\ \hline 71 \end{array}$$

7 students made this class error.

(b) Borrowing and not allowing for it.

$$\begin{array}{r} 60 \\ -3 \\ \hline 67 \end{array}$$

10 students showed this type of error.

(c) Increased the minuend after borrowing

$$\begin{array}{r} 40 \\ -6 \\ \hline 54 \end{array} \qquad \begin{array}{r} 40 \\ -1 \\ \hline 59 \end{array}$$

3 students demonstrated this error.

(d) Deducting 2 from the minuend

$$\begin{array}{r} 60 \\ -3 \\ \hline 47 \end{array}$$

5 pupils erred in this respect.

Thus 25 students or 12½% indicated lack of knowledge in regard to borrowing exclusive of those who misunderstood it in the zero problems.

6. Zero Difficulties.

(a) Zero in the minuend

(i) $\begin{array}{r} 50 \\ -9 \\ \hline 50 \end{array}$

Here 14 students obviously said 9 from 0 is 0 and then 0 from 5 is 5.

(ii) $\begin{array}{r} 50 \\ -9 \\ \hline 40 \end{array}$

Here there is similar procedure except that the 10 pupils seem to have an idea they should have borrowed 1 from 5 and thus left 4.

(iii) 40
-1
45

Here 3 students have apparently added 1 plus 4 equals 5 and then said 0 from 4 leaves 4.

(iv) 40
-1
5

2 students neglected the zero and added the other numbers.

(v) 40 60
-1 -3
31 33

Here the three students concerned have proceeded thus: 0 from 1 equals 1; 1 from 4 equals 3. Or in the second case, 0 from 3 equals 3; 3 from 6 equals 3.

This is much like type 4 above.

This first step could be 1 from 0 equals 1; that would indicate a failure to observe borrowing.

(vi) 50
-9
49

Here , 12 students have borrowed from the 5 , but wrote down the subtrahend instead of the remainder or else they subtracted 0 from 9 equals 0, and poorly understanding borrowing, deducted 1 from the 5 and wrote the answer 4.

(vii) 50
-9
59

This appears to be type 2 (addition instead of subtraction); but the 19 students concerned only did this where there was a zero in the minuend. So it is suggested that either borrowing was not understood or what is more likely, students said 9 from 0 must be 9 or that 0 from 9 leaves 9, and the second part would be 0 from 5 leaves 5.

It is difficult to say how many examples of type 2 have been classed as sub-section vii of type 6. But in these latter cases, the pupils did not add in other examples on the test.

Altogether 65 pupils erred in the problems involving a zero in the minuend.

This was the second division of A-2

20 pupils or 10 % got all the 10 marks allotted.

Question 5.- Here 28 students failed to realize that the series was in 5's. 11 more did the first three blanks in 5's but proceeded by 1's after 100.

Question 6.- 5 students failed to recognize the 10's series; 7 more placed the first two, but missed after 150. (It is significant that many students were writing 1005 for 105 or a similar type of error.)

Question 7.- Many students failed to notice the heading of "By how many is" above the question.

18 pupils added 200 to 180.
5 pupils wrote yes.
28 pupils did not try it.
1 pupil wrote 200 is greater.

Question 8.- Here again many students did not apply the heading to the section.

10 students wrote yes.
2 students added.

Question 8 was easier or clearer in meaning without the heading of "By how many is".

Only 32 pupils correctly interpreted Questions 7 and 8.

Writing Numbers.

The third section of the A part of the Test gave 4 questions on Writing Numbers. Here the children did well, 125 of them getting the full mark.

1. 7 students wrote 129 instead of 139;1wrote 149 instead. 16 students wrote 104 instead of 140; 1 wrote 16 instead 60. 1 wrote 80 for 108 and 1 wrote 114 instead of 140.

2. Wrote the 100; then the unit as one hundred eight -- 1008; one hundred thirty nine -- 10039

   4 students made this mistake; apparently these students went on counting from 100 and retained the idea of 100 and proceeded to repeat the process of 100 and 1 is 1001 and so on to 10039.

3. Used one cipher.

   One hundred thirty nine -- 1039.

   Here was the most common error. 21 students committed this mistake. These pupils have learned how to start out from 100 by proceeding 101, 102, ---109. Then they have continued into the next set with the zero and written 1010, ---1039, 1040.

4. One variation was interesting.

   One hundred forty appeared as 1 100+0.

   The pupil wrote the symbol for each separate word. It would appear that many pupils have drilled numbers orally and thus have never really seen the symbol.

5. Another single variation showed in writing one hundred thirty nine as 1309.

6. 14 students did not attempt number 3 and number 4.

7. 3 students left off the hundred and wrote the last

symbol only.

as one hundred eight--8.

one hundred thirty nine --39.

Notation.

This section involving writing the words for the symbols was correctly answered by 113 pupils.

Some children seemed completely unfamiliar with the words for the figures and wrote words that sounded like the symbol such as ate for eight. There were 9 cases that suggested the pupils were unfamiliar with the written name of the symbol.

2. 2 wrote the numbers over again.

(9) 6; (9) 6

3. 1 added the numbers and put down the sum.

(9) 6; 15

4. 10 did not try the question at all.

5. 8 pupils simply mixed the words up getting nine opposite six or ten opposite 7.

6. 3 students wrote the figure 7 in the first blank opposite 6 and continued to write the other names in consecutive order.

(9) 6; seven

(10) 7; eight

This question clearly indicated that many pupils are drilling in the symbols without knowledge of the written word forms.

Assorted Questions

There was a series of nine questions with an allocation of 17 marks.

A- 3 questions dealth with the ordinals.

B- 1 question tested the left hand knowledge.

C- 1 question tested for knowledge of even numbers.

D- 3 questions were of the "3 more than 25 is?" type.

E- 2 questions were for knowledge of Roman Numerals.

27 pupils scored a full mark on this section of the test.

Analysis of errors:-

A- 18 pupils made mistakes here, choosing for example the 8th instead of the ninth circle or

4 pupils read the 16th question incorrectly and put only one x in the circle.

9 pupils did not color any circle.

5 pupils colored 7 circles.

B- 22 pupils did not show knowledge of left hand from right asked for in question 14.

C- 102 pupils failed to get the even numbers between 30 and 50. Some put all the numbers between these two limits or else none.

The alloted mark of 9 for this question appears excessive in relation to the whole section and the principles tested.

D- 11 pupils did not interpret this type at all.

5 more subtracted.

12 pupils added incorrectly.

E- 68 pupils failed to give the correct Arabic symbols for the Roman Numerals; all these missed IX, although some knew VIII.

PART B

LANGUAGE.

The first section on language consisted of 12 questions which the child must comprehand and then make the necessary answer.

Only 5 pupils made a perfect score in this part of the test. Nevertheless the average score out of a possible 12 was 8.29 or 69%.

15 pupils scored less than 6 or 50%.

7 pupils scored 3 or less.

Many of the students did not know the meaning of trio or quartette asked for in Questions 3 and 4.

The most common error was in Question 8; 155 pupils erred. Most of them either marked one apple or else 3 apples.

The next most common error was made by 125 pupils in failing to judge ¼ of the measure in Question 7.

TELLING TIME.

In the first clock 6.30 or 7.30 was considered a correct answer.

In the third clock 9.15 or 10.15 was considered correct.

The total score was 3.

42 pupils scored the full mark.

47 pupils scored 0.

The Second clock occasioned the most errors, 136 pupils failing; most of them read it as 15 minutes to 2.

64 pupils failed to read the first clock correctly.

94 pupils failed to read the third clock.

DENOMINATE NUMBERS.

This section comprises Questions 4 - 7 inclusive of B - 2 and should be a separate section both on the test and on the key. The total score was 4 allowed for the 4 questions.

45 pupils scored 4. 25 pupils scored 0.

Errors:

86 pupils erred in stating the number of inches in 1 yd.

70 pupils erred in stating the number of inches in ½ ft.

47 pupils mis-stated correct number of pints equal to 1 qt.

38 pupils failed to give value of ½ dozen.

PROBLEMS.

The last section of the test consisted of ten problems with an allocation of 2 marks each, out of a possible 20 marks, the average score was 12.59.

16 students scored 20.

69 students scored 15 or over (75% or over).

157 students scored 10 or over (50% or over).

20 students scored less than 5 (less than 25%).

Problems always require examination of the data and using relevant data in a reflective process for a desired end. Vocabulary and reading comprehension too are taxed.

Vocabulary weaknesses showed in question number 2 and 9; many students did not understand the meaning of the word difference or subtract and commonly added the numbers given.

Then again when a problem has an unfamiliar wording, erross occur. Question number 7 brought a variety of answers such as 32, 38 and 28. The answer 32 suggests addition while 38 suggests an error in subtraction of borrowing without making allowance for it.

Several found the wording of Number 10 unfamiliar too and though many tried it unsuccessfully, others did not attempt it.

CHAPTER V

GRADE III

The Grade III test paper consisted of Part A and Part B with a total possible score of 131. 200 papers were marked for which the arithmetic mean was 69.69 or 53.1%.

The Norms for the entire test were:

75% of the pupils scored above 52.

50% of the pupils scored above 66.

25% of the pupils scored above 88.

Quartiles:

First Quartile was 54.1

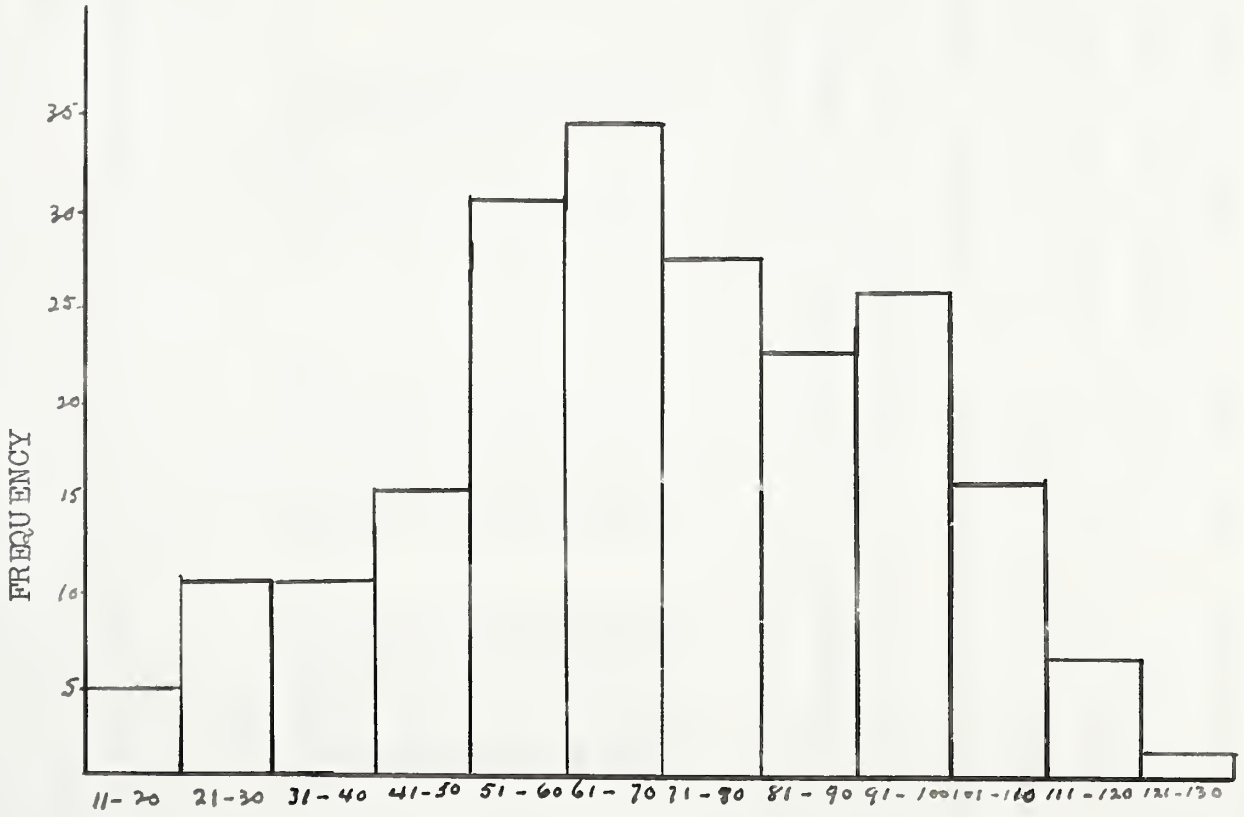
Median was 69.2

Third Quartile was 89.25

TABLE VI

FREQUENCY DISTRIBUTION OF TOTAL SCORES

No.of Cases	Score	No.of Cases	Score	No.of Cases	Score	No.of Cases	Score
1	11	2	48	1	71	2	92
3	15	2	51	3	72	3	93
1	20	5	52	2	73	6	94
1	22	6	53	5	74	3	95
1	24	1	54	5	75	3	98
1	25	2	55	3	76	3	99
1	26	2	56	3	77	3	100
4	28	4	57	1	78	2	101
2	30	2	58	2	79	3	102
1	31	4	59	2	80	3	103
2	33	2	60	1	81	1	105
1	36	2	61	3	82	3	106
2	37	3	62	2	83	2	107
1	38	5	63	3	84	1	108
1	39	4	64	1	85	1	111
2	40	4	65	3	86	1	112
3	41	6	66	2	87	1	116
1	42	2	67	3	88	2	117
2	45	2	68	3	89	1	118
3	46	3	69	1	90	1	121
4	47	3	70	2	91		



Class	Frequency
11-20	5
21-30	10
31-40	10
41-50	15
51-60	30
61-70	34
71-80	27
81-90	22
91-100	25
101-110	15
111-120	6
121-130	1

Total 200

Fig.3.- Frequency distribution of total Scores

TIME USED

The tests were not time tests; pupils were reminded that they need not hurry. However those who took the longest time did not make as high marks as those who used the shortest time. On each paper a blank was filled in, showing the time used for writing the test. From that data the following comparisons are made.

(a)		(b)		(c)	
Time	Score	Time	Score	Time	Score
41	105	122	72	92	71
48	106	125	67	96	52
40	53	130	86	98	112
42	101	165	87	90	101
50	82	145	51	95	102
62	99	195	46	91	99
36	99	188	28	93	57
43	116	210	56	85	74
38	103	180	47	89	64
49	58	200	63	90	66

Group (a) indicates the time in minutes and the scores of those who finished in the shortest time; beside it is another list (b) of the ten students who took the longest time with the time and scores shown. The average of the times in (a) is 44.9 minutes and the average of the scores is 92.2. The average of the times in (b) is 166 minutes and the average of the scores is 60.3. This would certainly give support to the common conception that the very rapid worker is usually more accurate than the very slow worker.

Most of the students used about 90 minutes and the list (c) indicates 10 scores chosen in that time class, showing an average time of 91.9 minutes and an average score of 79.8 . Even here the scores are not as high on the average as those of the fastest workers; it was one of the fastest workers who made the highest score of the whole 200 pupils with a mark of 116.

The slow student often loses time in trying to remember combinations or some factual matter which the faster student probably knows more readily. Longer time used does not indicate greater care.

TABLE VII

COMPARISON OF PUPILS FROM GRADED AND UNGRADED SCHOOLS IN AVERAGES ON THE GRADE III TEST

Type	Number of pupils	Aggregate	Average Score
Graded School Students	85	6272	73.7
Ungraded School Students	115	7667	66.6
Total	200	13939	69.69

The comparison of the two classes shows in this grade that the pupils in the graded schools made a higher average by 7.1 marks. Thetotal mark on the test paper was 131.

TABLE VIII

AGGREGATES AND AVERAGES IN EACH SECTION OF THE GRADE III TEST

	Possible Mark	Total Possible Aggregate	Actual Aggregate	Average Mark (Score)	Average Mark (%)
Spelling	15	3000	1614	7.07	47.1
Language	12	2400	1500	7.5	62.5
Activities	3	600	331	1.65	55.0
Denominate Nos.	15	3000	1628	8.14	54.2
Fractions	10	2000	912	4.56	45.6
Addition	4	800	583	2.96	74.0
Subtraction	4	800	504	2.52	63.0
Multiplication	12	2400	1749	8.74	72.8
Division	20	4000	1922	9;61	48.5
Generalizations	12	2400	441	2.20	18.3
Problems	24	4800	2755	13.77	57.3

The above table indicates the possible scores and aggregates as well as the actual aggregates and arithmetic means for each of the eleven types of questions on the Grade III test.

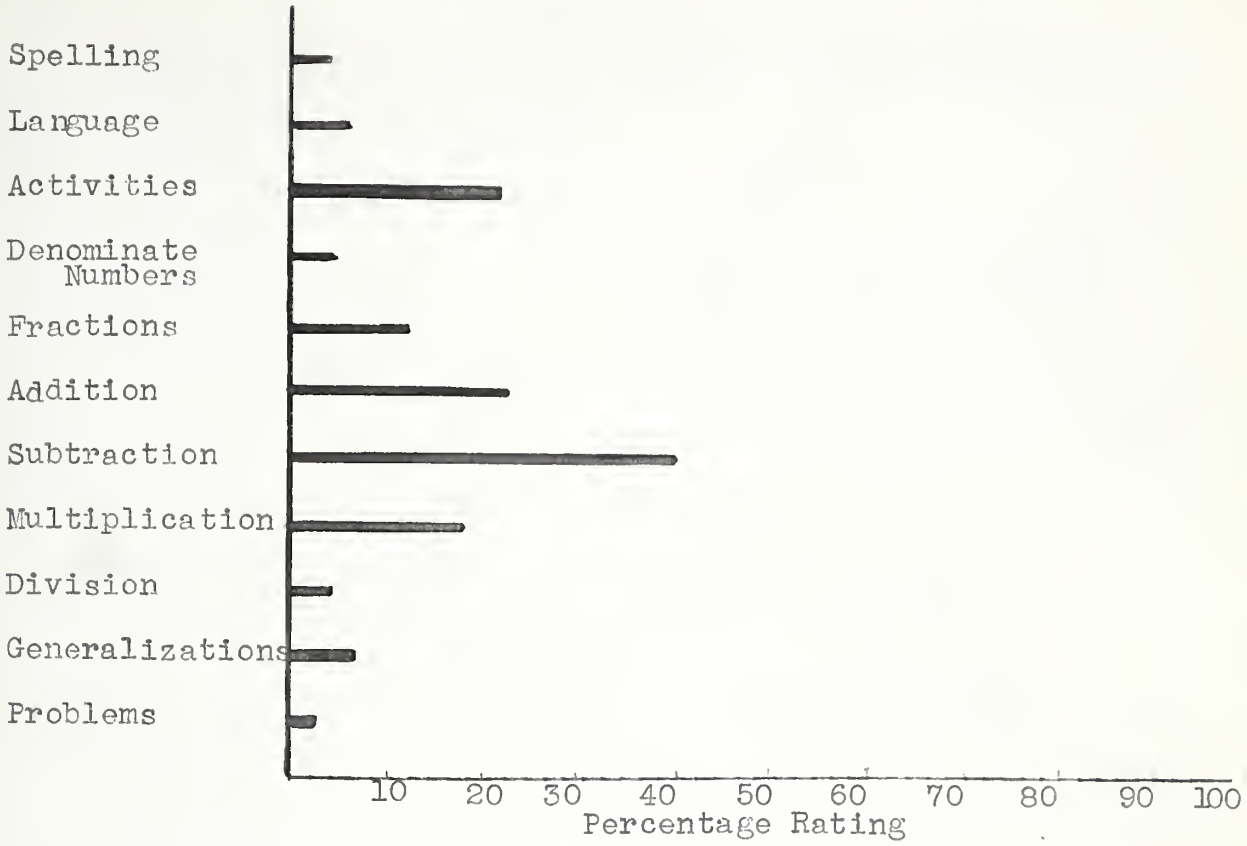


Fig. 4. - Percentage of answers scored correct in each section of the Grade III test paper.

TABLE IX

NORMS FOR EACH SECTION OF THE GRADE III TEST PAPER

	Possible Score on Test	75% of Pupils Scored above	50% of Pupils Scored above	25% of Pupils Scored above
Spelling	15	4	7	11
Language	12	5	8	9
Activities	3	0	1	2
Denominate Nos.	15	4	8	11
Fractions	10	1	4	7
Addition	4	1	2	3
Subtraction	4	0	2	3
Mulitiplication	12	7	9	10
Division	20	4	10	13
Generalizations	12	0	0	3
Problems	24	8	12	16
Total	131	52	66	88

SPELLING

The first section of the A part of the test was Spelling with an allocation of 15 marks.

5 pupils scored 15 (100%)

1 pupil scored 0 . 112 pupils scored 8 or more.

48 pupils scored 12 or more. 45 pupils scored 4 or less.

15 words were dictated by the teacher for the pupils to write down. All the words were shown misspelled over the whole group. Certain ones showed a common error:

1. weigh was spelled 'way' by 52 pupils.
2. 52 others interchanged the e and the i in weigh.
3. length- 32 pupils omitted the g.
4. equal - there were many errors; 36 spelled it equil.
5. group - 60 pupils left out the u
6. quotient- 56 students misspelled this word in six different ways.
7. Tuesday- 8 misspelled this as Tuseday or Tueday.
8. Monday - 16 pupils did not use the capital letter.
9. 36 pupils showed no idea at all of the spelling of nearly all of the words.

LANGUAGE

8 questions in this section were concerned with abbreviations and four more with choices of the right terms.

12 pupils scored the full mark of 12

14 pupils scored 0 . 152 pupils scored 6 or more .

93 scored 9 or more. 28 pupils scored 3 or less.

Certain definite types of errors occurred:

1. Added s to the proper abbreviation:

   quarts - qts. ; 56 made this error.

2. Wrote pd. for lb. - 44 erred in this

3. Wrote wrong part of the word-

   inc. for inches; oc. for ounce;

   28 erred in this type

4. 48 pupils definitely did not know what abbreviation meant.

5. Wrong word substituted:

   108 made mistakes regarding the use of product or quotient.

6. 12 pupils misspelled the words.

7. 32 pupils had no idea of what was right in the blanks of Questions 9 - 12.

8. 8 pupils did not try the section.

ACTIVITIES

This section required the pupils to draw a line one half of a given length, a square of given dimensions, and a circle with one third of the area shaded. This was a comprehension test as well. The total score was 3.

43 pupils scored 3. 63 pupils scored 1.

68 pupils scored 2. 26 pupils scored 0.

Difficulties may be analyzed as:

1. poor judgment;
   16 apparently guessed at the length of the line.
   84 divided the circle badly;- usually into quarters.
2. Careless reading:
   24 drew a line twice the given length
   20 made a square of the wrong size - commonly $\frac{1}{2}$" instead of $1\frac{1}{2}$".
3. 4 did not try the section and 4 others seemed to have no idea of what was wanted.
4. 36 made poor squares - sides unequal.

DENOMINATE NUMBERS

15 questions tested for factual knowledge of denominate tables; some fractions were included.

4 pupils scored the full mark of 15.

59 pupils scored 12 or more.

102 pupils scored 8 or more.

41 pupils scored 4 or less.

Description of Difficulties:

1. Lack of knowledge of relationships:
   96 pupils apparently lacked the factual knowledge.
   8 did not try the exercise and another 12 pupils had little idea of what they were doing and simply put down numbers.
2. Wrong procedures:
   6 pt. = 12 qt.
   12 pupils multiplied instead of dividing.
3. 48pupils seemed to know the relationships, but added or multiplied incorrectly.
4. Weakness in fractions:
   $\frac{1}{2}$ of \$3.60 equals \$1.30 or $7\frac{1}{2}$ ft. equal 84 in.

4 inches equals $\frac{1}{4}$ ft.

104 pupils showed errors on the first example of $3.60 alone; 36 stated that 4 in. = $\frac{1}{4}$ft.

FRACTIONS

10 questions with a score of 10 comprised this section.

11 pupils scored 10. 97 pupils scored 5 or more.

41 pupils scored 8 or more. 83 pupils scored 3 or less.

Types of Questions and Difficulties Involved:

1. Changing a fraction to one of equal value with a new denominator. (Question 1)

   88 pupils failed to do this.

2. 1/3 doz. equals ? The common answer here was 3.

3. 'of' implies multiplication: (Questions 3, 4, and 7)

   1/3 of 15 equals ?

   72 students erred in these questions but all,with the exception of 6, apparently understood the procedure but did not know the tables.

4. Unusual wording of Questions 5 and 6.

   5 is $\frac{1}{4}$ of ? 1/3 of _____ is 6.

   90 pupils failed in one or both of these examples; the common answer to the first was 10; in the second example the pupils took 1/3 of 6.

5. Time- Questions 8 and 9.

   $\frac{1}{2}$ minute equals ____ sec. ; 1$\frac{1}{2}$ hr. equal _____ min.

   80 students failed to answer correctly.

6. Question 10 required recognition of 12 in. = 1 ft. and it required correct multiplication. The common answer was 27 in., indicating that 1/3 ft. had been considered as 3 in. to be added to the 24 inches.

FUNDAMENTALS

Four sections were treated in this section - addition, subtraction, multiplication, and division.

ADDITION

4 questions were give given - total score was 4.

72 pupils scored 4

71 pupils scored 3. 20 pupils scored 1.

31 pupils scored 2. 6 pupils scored 0.

Common Errors:

1. Weakness in Combinations: - 80 erred in this respect
2. Carrying difficulties: - 14 made mistakes.
3. Omission of the decimal point and dollar sign:- 8 erred.

SUBTRACTION

Here there were also 4 questions with a score of 4.

89 pupils scored 4.

37 pupils scored 3 . 17 pupils scored 1.

28 pupils scored 2 . 38 pupils scored 0.

There was a greater variety of errors:

1. Weakness in combinations - shown by 28 pupils.
2. Zero in the minuend -

```
 620
 357
 267
```

Here 10 students subtracted the zero from the 7.

3. 14 pupils omitted the dollar sign and the decimal point.
4. Subtracted the minuend from the subtrahend-

```
 923
 469
 546
```

4 students subtracted the smaller numbers as 3 from 9; 2 from 6; and then 4 from 9.

5. Increased the minuend after borrowing -

```
 5.00
 2.76
 4.24
```

4 students erred in this type; borrowed 1 and increased the 5 to 6; 2 from 6 leaves 4.

6. Borrowed without making allowance -

```
 620
 357
 373
```

32 pupils made this mistake.

7. 1 pupil deducted 2 from the minuend in borrowing; another 2 pupils added instead.
8. Subtracting from Zero -

```
$ 5.00
  2.76
  3.76
```

6 from Ø equals 6; 7 from 0 equals 7. This error is similar to type 2 above, and it is difficult to be sure about the 4 students classed for this.

MULTIPLICATION

12 marks were allowed for the 12 examples on this section.

34 pupils scored 12 marks. 169 pupils scored 6 or more.

139 pupils scored 9 or more. 19 pupils scored 3 or less.

Description of errors:

1. Poor knowledge of multiplication tables -

312
 2
724

74 pupils erred in this type.

2. Carrying difficulties -

278 46
 3 2
824 82

50 students failed to carry or only partially did so.

3. 16 pupils omitted the dollar sign and the decimal point

4. 2 students multiplied only one digit of the multiplicand -

24
 2
28

5. Zero difficulty -

$ 3.07
 4
12.87

2 students apparently multiplied the 7 and had 2 to carry; then they put down the 7 and multiplied the 2 by 4 and put down 8 as the answer.

DIVISION

In this section there were 10 questions of 2 parts each with a total allocation of 20 marks. All the divisors were single digit numbers.

3 pupils scored 20 (100%) 108 pupils scored 10 or more.

37 pupils scored 15 or more. 57 pupils scored 5 or less.

Division was the lowest showing in the section on fundamentals with the average at 48.5%.

Difficulties:

1. Poor knowledge of multiplication tables -

$2\overline{)48}$ 23

86 pupils erred in this respect.

2. The most common mistake was in writing plus 1 or more commonly -1 as the remainder -

$2\overline{)57}$ 28 -1

94 pupils erred in this regard.

3. Omitted the remainder -

$2\overline{)57}$ 28

19 students omitted the remainder.

4. 46 pupils omitted the dollar sign and the decimal point.

5. Zero difficulty -

$3\overline{)240}$ 8

8 pupils did not know what to do about the zero.

PART B

GENERALIZATIONS

4 questions were asked on procedure involving knowledge of the Denominate Tables. 3 marks was the score for each question.

7 students scored 12 (all questions correct)
11 students scored 9 (3 questions correct)
25 students scored 6 (2 questions correct)
36 students scored 3 (1 question correct)
121 students scored 0 (0 question correct)

Difficulties:

The children seemed to know the relationship of the tables; most of them , for example, knew there were 12 in. in 1 ft. for the first question but said to divide rather than multiply; a few suggested adding or subtracting. But the chief difficulty was whether to multiply or divide.

The children found the second question the easiest; 46 pupils answered it correctly; the next highest was 34 correct answers for the third question. Question 1 and Question 4 were responded to correctly by 30 pupils.

Of the 7 students who scored full marks, 4 were from urban schools and 3 from rural schools. Of the 11 students who scored 9 marks, 8 were from rural schools and 3 from urban centres.

PROBLEMS

The last section of the test consisted of 12 questions (problems) valued at 2 marks each.

3 pupils scored 24 (full mark) 144 pupils scored 12 or more
49 pupils scored 18 or more. 21 pupils scored 6 or less.

The average mark for the 200 pupils was 13.7 or 53.1%

Question 1 - Nearly all the students answered this question.

Question 2 - Pupils either gave the answer or made up a set of conditions completely irrelevant.

Question 3 - Many added the figures given; they did not seem to understand the word 'subtraction'.

Question 4 - Nearly all did this one.

Question 5 - The procedure was nearly always correct; but the multiplication by 2 was commonly incorrect.

Question 6 - Procedure usually correct; common answer was 125 instead of $1.25.

Question 7 - Faulty reading ; wrong answer was usually 35.

Question 8 - Results in this question were poor; the pupils did not read correctly or else thought that remainder meant quotient again, thus they gave the quotient as the answer. They often divided incorrectly so that 33, 34 , or 36 were common answers.

Question 9 - Division by 2 was usual; but 8 was commonly written instead of 8¢.

Question 10 - Results were poor; many divided incorrectly by 4, or else they multiplied.

Question 11 - The common error wasto leave out the decimal point in $2.40 or else misplace it. The zero was commonly omitted.

Question 12 - This was the hardest question for many. It involved 3 operations which seemed beyond the ability of a large number of the pupils.

CONCLUSION

Apparently many of the pupils do not know the meaning of subtraction and other terms. In the classroom , there is often too much use of the term, 'take-aways' and the child does not become sufficiently familiar with the language. Many refer to a product or a quotient as an answer and showed in this test that they did not understand the words either in use or in spelling. The course requires that pupils be familiar with the language necessary for the subject matter.

There is strong evidence that the fundamentals are drilled by mechanical processes. Pupils can multiply or subtract if told what is to be done; but they do not understand varieties of presentation of the same situation, so that they must decide what figures shall be used and how. More emphasis appears to be needed on recognizing procedures required, such as the section on generalizations demanded. It also appears that exactness should be emphasized in form, as for example in specifying what a remainder is, in division. A large number of students placed the remainder as a whole number after the quotient with a minus sign between them.

CHAPTER VI

GRADE IV

The Grade IV test paper consisted of Part A and Part B with a total score of 118. 200 papers were marked for which the mean was established at 58.7 or 49.7%.

The mode was 78.

Quartiles:

The First Quartile was 45.

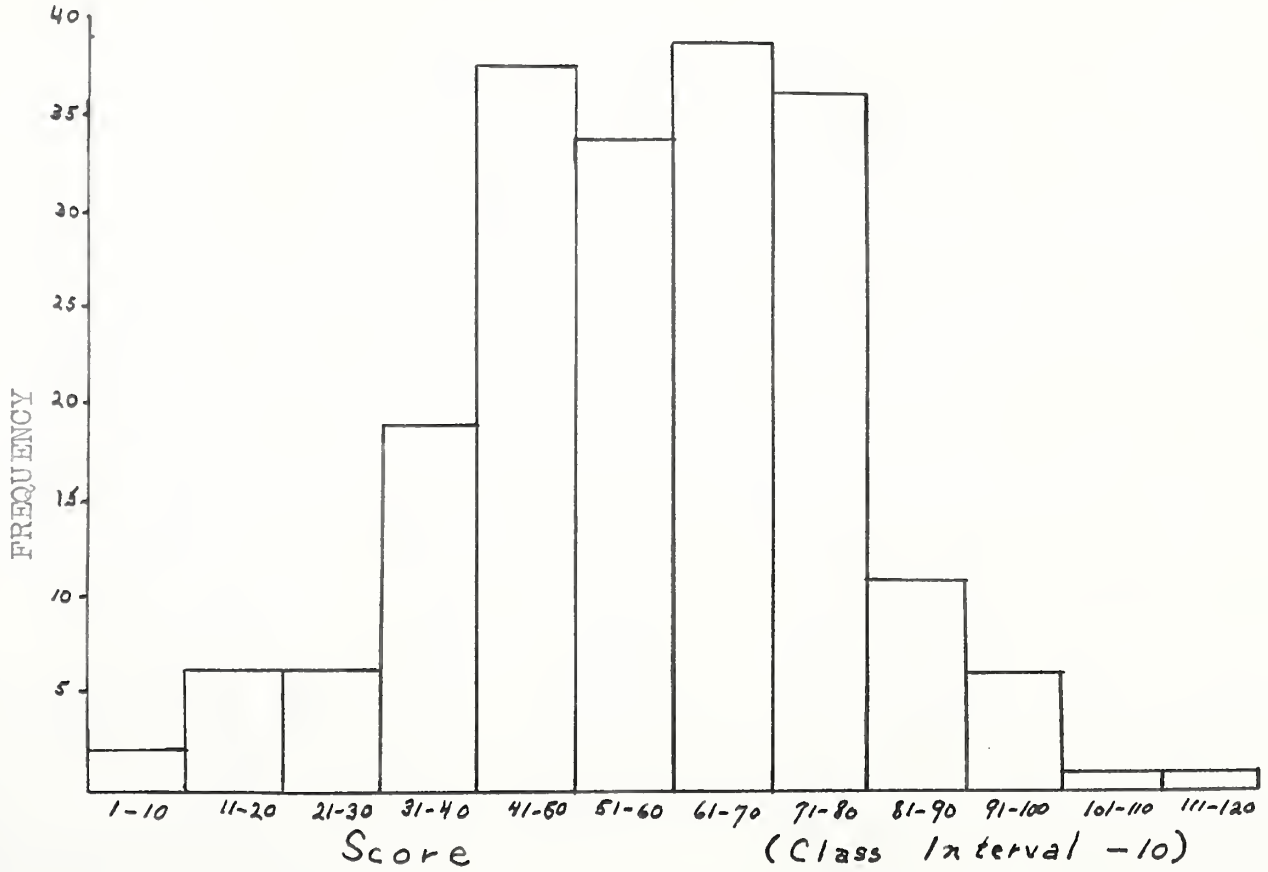
The Median was 59.3

The Third Quartile was 72.7

TABLE X

FREQUENCY DISTRIBUTION OF TOTAL SCORES

No.of Cases	Score	No.of Cases	Score	No.of Cases	Score	No.of Cases	Score
2	6	1	42	4	60	4	77
1	13	5	43	6	61	8	78
2	14	6	44	4	62	4	79
1	15	2	45	2	63	2	80
2	18	3	46	5	64	2	82
1	23	4	47	3	65	2	83
1	27	7	48	6	66	1	84
2	28	3	49	4	67	2	86
2	30	5	50	2	68	3	89
1	33	6	51	6	69	1	90
3	35	4	52	1	70	1	92
2	36	4	53	2	71	1	95
4	37	2	55	2	72	1	96
2	38	1	56	4	73	1	97
4	39	4	57	4	74	1	98
3	40	5	58	4	75	1	99
2	41	4	59	3	76	1	103
						1	113



Class	Frequency
1 – 10	2
11 – 20	6
21 – 30	6
31 – 40	19
41 – 50	38
51 – 60	34
61 – 70	39
71 – 80	37
81 – 90	11
91 – 100	6
101 – 110	1
111 – 120	1
Total	200

Fig.5- Frequency distribution of Scores

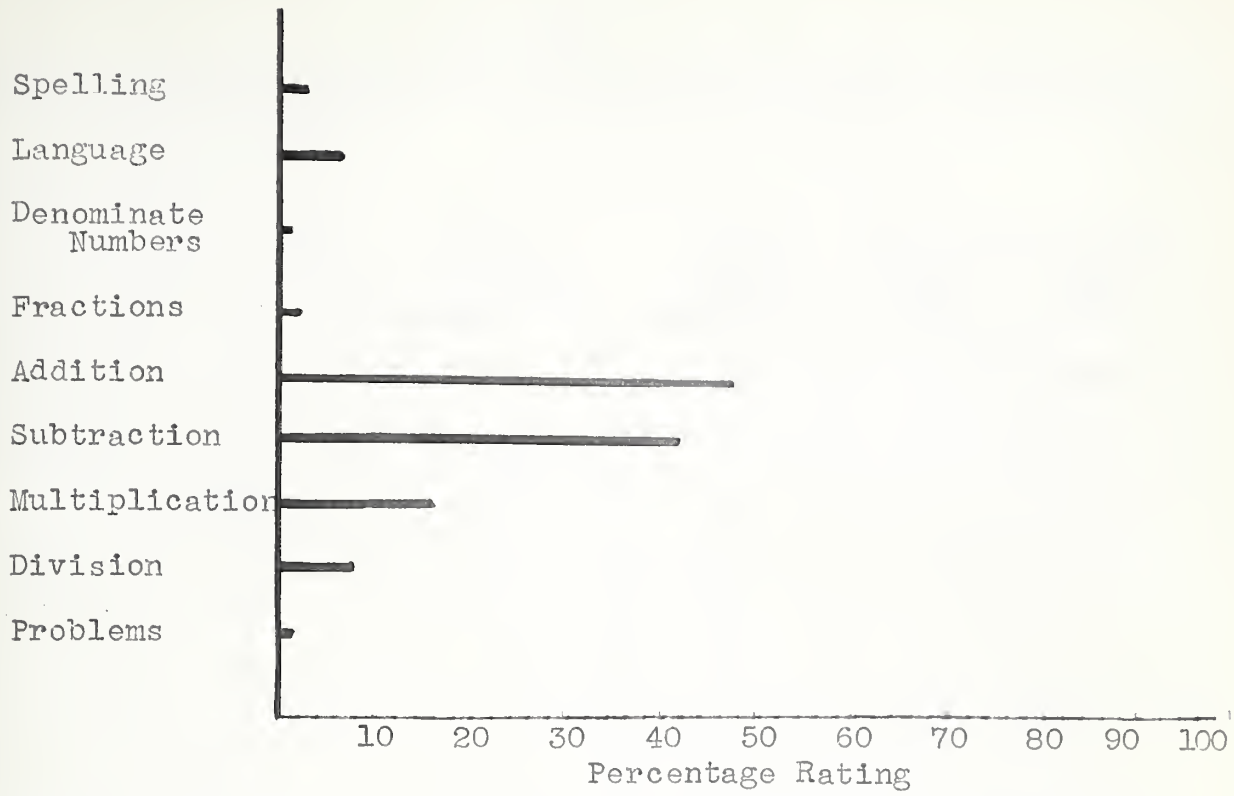


Fig. 6. - Percentage of answers scored correct in each section of the Grade IV test paper.

TABLE XI

NORMS FOR EACH SECTION OF THE GRADE IV TEST

	Possible Score on Test	75% Of Pupils Scored above	50% of Pupils Scored above	25% of Pupils Scored above
Spelling	18	8	10	13
Language	6	0	1	2
Denominate Nos	21	7	11	13
Fractions	15	4	7	9
Addition	4	2	3	3
Subtraction	4	2	3	3
Multiplication	14	7	10	12
Division	10	0	2	5
Problems	26	2	6	11
Total	118	44	58	73

There were nine sections on the Grade IV test paper, representing nine different types of questions.

TABLE XII

	Mark Allowed	Total Possible Aggregate	Total Actual Aggregate	Average Mark Score	Average Mark %
Spelling	18	3600	2171	10.85	60.2
Language	6	1200	336	1.68	28
Determinate Nos.	21	4200	2271	11.35	54.4
Fractions	15	3000	1518	7.59	50.6
Addition	4	800	641	3.20	80.
Subtraction	4	800	601	3.00	75
Multiplication	14	2400	1968	9.84	70.2
Division	10	2000	734	3.67	36.7
Problems	26	5200	1504	7.52	28.9

The table above indicates the possible scores and aggregates as well as the actual aggregates and arithmetical means for each of the nine types of questions on the Grade IV test.

SPELLING.

Section One of Part A of the test allotted 18 marks for 18 words to be written as dictated by the teacher.

2 students scored 18. 154 students scored 9 or more.

98 students scored 14 or more. 16 students scored 5 or less.

The mode was 25.

There was a great variety of mistakes. The first word average was usually correct, so also were rod, wheat, barley and mile.

1. account - was most commonly written acount; an error occurring 156 times.
2. perimeter - misspelled 112 times either left out the i or placed i instead of e before t.
3. temperature - spelled either temperture or temperchure ranked next with 108 errors.
4. thermometer - ranked close with 96 errors.
5. statement - was commonly spelled statment - 92 errors.
6. rectangle - spelled as recktangle showed error 48 times.
7. section - had varied spellings amounting to 56 errors.
8. vegetables - misspelled 76 times usually had an a after the g.
9. sales - a considerable number, 28 in all, wrote sails.

Spelling should be closely associated with pronounciation. The errors seemed to indicate that the students were trying to spell the words as they are commonly pronounced.

LANGUAGE.

Six questions comprised this second section of the test. Total score was 6.

Distribution of Scores:

No. of Students.	Score	No. of Students	Score
1	6	51	2
1	5	62	1
20	4	38	0
27	3		

The Arithmetic mean was 1.68 or 28%.

The mode was 2.

The students were unfamiliar with the terminology.

Comments on Questions and Difficulties.

1. Few pupils had a clear idea of what average meant. The first 2 questions demanding this knowledge reflected 140 pupils did not know what to do; several drew a line but so incorrectly that it was clear they had had no definite plan of procedure.

2. 75% of the pupils were not able to tell how to multiply by 100; they said to add one zero or to add the numbers. But many of these students did multiply by 100 correctly in the multiplication exercises. So it would appear that the mechanical processes are known better than the methods of procedure.

3. Questions 4 and 6 were of the same type - to ascertain whether the pupil knew when to divide or multiply. Here lay the error for again 75% of the pupils said to multiply - Question 4 and to divide in Question 6. Most of them knew the Denominate Numbers relationships. In question 4 the pupils seem to have been thinking, "There are more quarts", so multiply. And in the last question a rod appeared bigger - so divide.

4. Question 5 was answered best; still it wanted to see if the child knew a square from a rectangle; 34% did not make that distinction.

DENOMINATE NUMBERS.

Twenty one blanks gave opportunity for showing nearly all the denominate numbers tables required - length, volume, number, area and bushel weights of different grains as the total score was 21. Manipulation of fractions was required in five cases. The average score was 11.35 or 54.4%.

1 student scored 21 (100%) 112 students scored 11 or more
40 students scored 16 or more. 22 students scored 5 or less.

The mode was 13.

Errors:-

1. Weakness in Denominate Relationships. 64% of the pupils did not know all the tables. This was particularly noticeable in weights of bushels of different grains and in yards or rods in a mile. The student commonly said 5,280 yds. to a mile, having thought of feet apparently.
2. There were 32 cases (or 16%) of mistakes in calculation that indicated difficulties with multiplication tables or fractions. Common among these was 11/6ft. equals 15".
3. There were examples of multiplying where dividing was required as illustrated in the error, 13 pt. equal 26 qt.
4. Question 14 regarding area was omitted by many; as well 25% made a mistake in the answer. Usually they subtracted the 6 (length of a side) from the 40 (area in square feet). Pupils in Grade IV often do not study area. These confused area with perimeter.
5. 6 students showed the error of marking the remainder as a minus quantity after the quotient. For Question 10 the answer thus shown was : 13 pt. equal 6 - 1 qt.

FRACTIONS

This last section of Part A of the test consisted of 12 questions. The principles tested include all demanded by the Course of Study.

Principles Included:	Question Number.
1. Equivalent Fractions	1 and 8
2. Finding a fraction of a number	2, 3 and 4
3. Addition of Unit Fractions	
(a) With Similar Denominators	5
(b) With Unlike Denominators	12
4. Subtraction of Unit Fractions	6 and 7
5. Addition of Mixed Numbers	
(a) With Similar Denominators	11
(b) With Different Denominators	10
6. Subtraction of Mixed Numbers	9

The total mark allotted was 15, there being 4 marks for the first question.

2 pupils scored 15 (100%) 116 pupils scored 8 or more

27 pupils scored 12 or more. 40 pupils scored 4 or less.

The average (arithmetic mean) was 7.59. The mode was 9.

Types of Errors:

1. Addition instead of subtraction.

   $\frac{1}{2} - \frac{1}{4}$ equals $\frac{3}{4}$ $3\frac{1}{2} - 2\frac{1}{4}$ equals $5\frac{3}{4}$.

   112 pupils or 56% made this error, apparently not understanding the minus sign.

2. Lack of knowledge of equivalent fractions.

   $\frac{1}{2}$ equals 8/6 equals 12/4.

   40 pupils (20%) erred in procedure of changing fraction to one of equal value with a new denominator.

3. Adds Numerators.

   1/9 plus 1/9 plus 1/9 equals 3.

   8 pupils (4%) showed this mistake. They do not understand nature of a denominator.

4. Add Denominators.

   1/9 plus 1/9 plus 1/9 equals 27. 1/3 plus 1/6 equals 9.

   22% of the students failed to express knowledge of adding numerators and putting the sum over the common denominator.

5. Does not understand need of a common denominator for addition or subtraction.

   1/3 plus 1/6 equals 2/9.

   28% of pupils erred in this regard.

6. Adds all numbers in mixed fractions:

   $5\frac{1}{2}$ plus $\frac{1}{4}$ equals 13.

   (5 plus 2 plus 4 equals 13). This was not common but 5 examples were noted.

7. Poor knowledge of Multiplication Tables:

   1/8 of 56 equals 8.

   22% of pupils erred in calculations of this type.

PART B

The second part of the test consisted of exercises on the four fundamentals and a set of 12 problems.

ADDITION

4 questions of 1 mark each comprised this section. The average mark was 3.2 or 80%. This was the highest average mark made for any section of the test.

94 pupils scored 4 (100%)
62 pupils scored 3
27 students scored 2
14 students scored 1
3 students scored 0.

The types of questions were four digits wide and four digits high in two examples and three digits wide and four digits high in four other questions, two of which involved dollars and cents.

Three main types of errors occurred:

1. Weakness in combinations.

```
 3265
 1794
 7686
-----
12746
```

6 plus 4 plus 5 equals 16

This was the most common type of error and appeared on 49% of the papers.

2. Carrying difficulties.

```
 3265
 1794
 7686
-----
11735
```

20% of the pupils failed to 'carry' in the second and in the last columns.

3. Neglect of dollar sign and decimal point.

```
$ 8.25
  4.49
  3.74
  2.95
------
 1943
```

6% of the papers showed similar neglect.

SUBTRACTION

Four questions with four digit numbers comprised the section on subtraction. All questions involved borrowing; 3 had zero in the minuend, though none had a zero in the subtrahend. The results ranked next to those of addition with 75% as the

average score; the mode was 4.

92 pupils scored 4 (100%)

54 pupils scored 3. 12 pupils scored 1.

29 pupils scored 2. 13 pupils scored 0.

Analysis of Errors:

1. Weakness in combinations:

```
5361
2824
2536
```

pupil subtracted 4 from 11 = 6.

28% erred in this type.

2. Borrowing without making allowance.

```
7000
2946
4154
```

Pupil subtracted 9 from 10 instead of from 9.

27.5% made this error.

3. Zero difficulty; - zero in the minuend.

```
6052
3628
3624
```

Pupil says 6 from 0 is 6; of else subtracts the 0 from 6.

18% erred in this type.

4. Addition instead of subtraction.

```
6104
3761
9865
```

7 examples of this error appeared.

5. Deduction of 2 from the minuend in borrowing.

```
7000
2946
3054
```

pupil subtracted 2 from 5.

7 examples of this error appeared.

This error is similar to type 1, but usually the pupil had crossed out the 7 and marked a 5, thus indicating what the nature of the error was.

MULTIPLICATION

The examples in this section included facts to 10 times 10 with multiplication by one and two digit numbers. Multiplication by 10 and 100 was included as well, so that all demands of the course were represented. Dollar and cents questions were included.

31 pupils scored 14 marks (100%)

106 pupils scored 11 or more. 18 pupils scored 4 or less.

166 pupils scored 7 or more. 5 pupils scored 0.

Types of Difficulties:

1. Weakness in multiplication tables.

```
 472
  46
2832
1898
```

Pupil states 4 times 7 is 29.

36% of the pupils erred through lack of knowledge of the multiplication tables.

2. Zero Difficulties.

(a) zero in the multiplier.

```
 345
  70
-----
3415
```

30% of the pupils did not understand the procedure for the zero.

(b) Zero in the multiplier and in the multiplicand.

100 times 20 equals 200.

4 cases of errors appeared of this type. Apparently the students were applying the rule to add two zeros when multiplyimg by 100 and have overlooked the zero in the 20.

3. Carrying difficulties.

```
 256
  73
-----
 758
```

Pupil did not carry the 1 from the 18 to add with the product of 3 times 5.

18% of the pupils erred in this type.

4. Incorrect addition

```
  256
   73
 -----
  768
 1792
------
18788
```

Pupils says 9 plus 7 is 17.

8 pupils erred in this type.

5. Incorrect placing of the product.

```
 472
  46
-----
2832
1888
-----
```

3 pupils did not understand placing the product of 4 times 2 directly under the 3 below the multiplier,4.

DIVISION

Ten examples comprised this section with division of four place numbers by one digit divisors. The idea of division to find averages had been tested for in the

Language section. Six examples had 2 digit divisors each e ending in zero. The total score was 10.

8 pupils scored 10 (100%)

31 pupils scored 8 or more.

71 pupils scored 5 or more.

103 pupils scored 3 or less.

36 pupils scored 0.

Description of Difficulties.

1. Weakness in Multiplication Tables.

$$6\overline{)4138}\quad 789$$

Pupil states there are 7 6's in 41.

35% of pupils erred in this type.

2. Remainders not expressed as fractions.

$$6\overline{)4138}\quad 689\ -4$$

The course requires that remainder be placed over divisor for a fraction 4/6.

40% of pupils showed this error.

3. Zero difficulties:

(a) zero in dividend.

$$7\overline{)5604}\quad 8\ 4/7$$

Student did not put down 0 when he tried 7 into 0 or again when he tried 7 into 4.

12 students made this type of error,

(b) Zero in Divisor.

$$60\overline{)812}\quad 137$$

Pupil neglected the zero and divided by the 6 only.

12 students (6%) erred in this.

(c) Zero in both divisor and dividend.

$$20\overline{)160}\quad 80 \qquad 70\overline{)4200}\quad 600 \qquad 70\overline{)4200}\quad 6$$

In the first two examples it appears the students were saying 2 goes into 16 8 times; zero into zero goes 0. In the last case the student either considered the answer was nothing or else neglected all the zeros.

32 % of the pupils erred in this type.

(d) Added zero to quotient.

$$40\overline{)562}\quad 140$$

12 students showed this error type but is possible they were dividing by 4. The work was not shown.

4. Neglected dollar sign and decimal.

$$8\overline{)\$78.26}\quad 978\tfrac{1}{2}$$

10% erred in this respect.

PROBLEMS.

Twelve problems comprised the last section of the test. Averages, simple fractioned and denominate table relationships involving the four operations were all represented. One question asked for a sales slip giving an extra 2 marks for form. Thus total score for the set of problems was 26.

1 pupil scored 26 (100%)
10 pupils scored 18 or more
38 pupils scored 13 or more.
49 pupils scored 6 or less.

The mode was 8.

Distribution of Failures; 200 students.

12 (a) form 12 (b) calculation.

No. of Question	1	2	3	4	5	6	7	8	9	10	11
No. failing to do Problem	148	116	136	124	116	52	180	144	155	131	144

(a)	(b)
12	12
128	92

Difficulties; It is difficult to ascertain the nature of errors in many of the problems as no work is shown. In the suggestions for changes in the test, I would suggest space be given on the paper where calculations are to be shown.

Question 1 was on the average of lengths but the student may have erred through ignorance of the denominate tables, or manipulation of fractions. But what seemed most probable was that the student, not understanding averages, left the sum of the lengths as the answer.

Question 2. Many gave as the answer; the cost of the 6 tickets and did not subtract this from the $5.00

Question 3. Many multiplied the 90 times the 80¢ without changing the pounds to bushels. Some did not use 60 pounds as the weight of a bushel of potatoes.

Question 4. The price was 11¢ a quart. There was 5 gallons of milk. The common error was to multiply 5x11. Students failed to change the gallons to quarts.

Question 5. The usual error in the estimate arose from neglecting the fractions and multiplying the whole numbers, so that $2.72 was a common answer.

Question 6. This was easier for over 75% of the students did what was asked for.

Question 7. This is a question on area. Few children of Grade IV seem to understand area in sq. ft. Many of them added the length and width.

Question 8. The error here arose from saying to add the length and width together and then not mentioning to multiply the sum by two.

Question 9. The students did not have a good grasp of the fractional idea. Others did not understand the question. Many added the numbers; e.g. 5 ft., $5\frac{3}{4}$ in. equal $10\frac{3}{4}$ ft. Some gave as an answer to this example $5\frac{1}{2}$ ft. I would suggest putting the word whole before foot in the question.

Question 10. Error most common was to multiply the number of eggs (72) times the price per dozen (15¢).

Students failed to reason from the reading that they must have the number of dozen since the price applied to a dozen.

Question 11. The student did not establish the relationship between 20 minutes and 2½ hours. Nearly all the errors arose from multiplying the time it took to walk a mile by the total time.

20 x 2½ equals 50 miles.

Question 12. Most students tried to use the data on the question as the body of the sales slip by ruling lines around it and leaving off the heading. Many wrote "Bought of Mrs. Brown" instead of "Sold to".

Errors in calculation usually arose from failing to multiply the cost per unit by the quantity number.

e.g. 4 loaves of bread .10

2 lbs. butter .23

Others made mistakes in addition by faulty combination.

CHAPTER VII

GRADE V

The Grade V paper consisted of Parts A, B, and C for a total score of 153. The papers of 200 students were marked; the arithmetic mean thus established was 88.63 or 57.9%.

The mode was 88

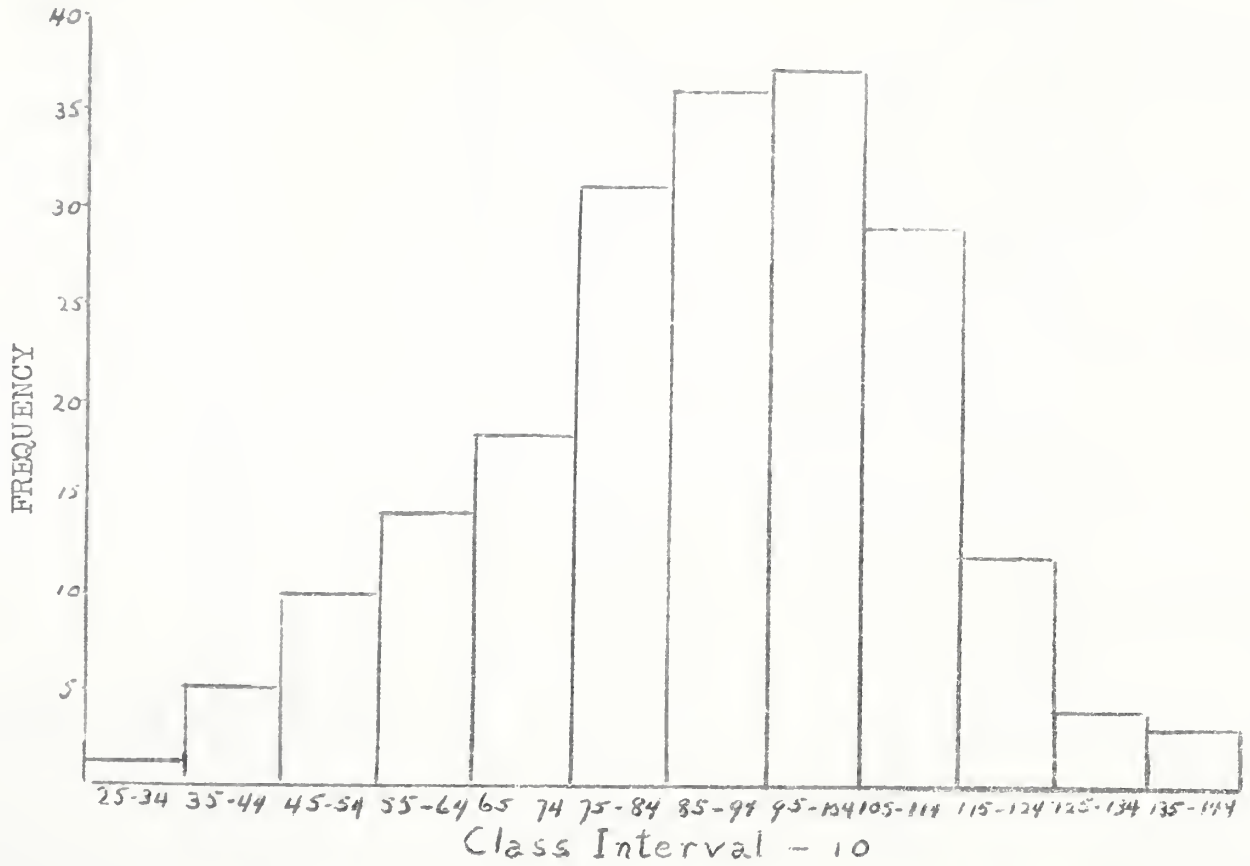
The median was 90.5

Q_1 was 74.8 ; Q_3 was 103.1

TABLE XIII

FREQUENCY DISTRIBUTION OF SCORES

No.of Cases	Score	No.of Cases	Score	No.of Cases	Score
1	25	2	73	4	101
2	35	2	75	2	102
1	38	4	76	1	103
1	40	1	77	2	104
1	44	4	78	3	105
1	45	1	79	2	106
1	47	5	80	4	107
1	48	4	81	3	108
1	49	3	82	2	109
1	51	2	83	4	110
1	52	5	84	6	111
4	54	2	85	3	112
3	55	5	86	3	113
4	56	5	87	3	115
2	58	7	88	3	116
1	59	1	89	1	117
1	60	1	90	1	119
1	61	5	91	2	120
1	62	3	92	1	121
1	64	4	93	1	124
3	65	3	94	1	127
1	66	5	95	1	130
2	67	5	96	1	131
2	68	6	97	1	133
3	70	4	98	1	135
1	71	6	99	1	137
4	72	2	100	1	144



Class	Frequency
25 - 34	1
35 - 44	5
45 - 54	10
55 - 64	14
65 - 74	18
75 - 84	31
85 - 94	36
95 - 104	37
105 - 114	29
115 - 124	12
125 - 134	4
135 - 144	3
Total	200

Fig. 7. - Frequency distribution of total scores

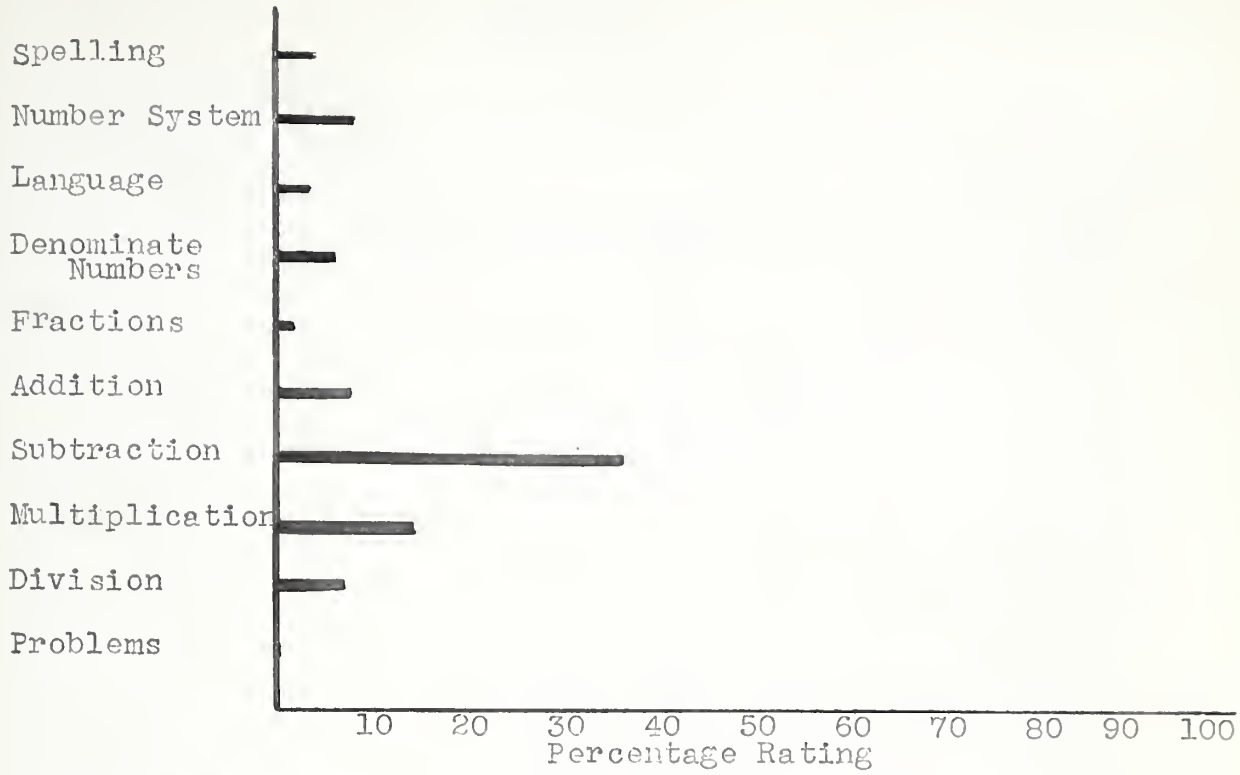


Fig.8.- Percentage of answers scored correct in each section or type of questions in the Grade V test.

TABLE XIV

NORMS FOR EACH SECTION OF THE GRADE V TEST

	Possible Score on Type	75% of Pupils Scored above	50% of Pupils Scored above	25% of Pupils Scored above
Spelling	16	9	10	12
Number System	7	0	2	4
Language	4	0	0	1
Denominate Nos.	12	4	6	8
Fractions	37	17	24	28
Addition	15	8	11	13
Subtraction	8	5	6	7
Multiplication	6	2	3	4
Divisions	14	1	8	11
Problems	34	8	12	18
Total	153	75	89	111

TABLE XV

	Possible Score on Type	Possible Aggregate -	Actual Aggregate -	Average Mark Score	Average Mark %
Spelling	16	3200	2229	11.14	69.6
Number System	7	1400	616	3.08	44.0
Language	4	800	279	1.39	34.7
Denominate Nos.	12	2400	1429	7.14	59.5
Fractions	37	7400	4710	23.55	63.6
Addition	15	3000	2204	11.02	73.4
Subtraction	8	1600	1298	6.49	81.1
Multiplication	6	1200	730	3.65	60.8
Division	14	2800	1473	7.36	52.5
Problems	34	6800	2759	13.79	40.5

The above table indicates the possible scores and aggregates as well as the actual aggregates and arithmetic means for each of the ten types of questions on the Grade V test.

PART A

SPELLING.

The first section of the Part A Test consisted of 16 words dictated to the pupils. The average mark for the 200 students was 11.14 or 69.6%. The mode was 12.

4 pupils scored 16 (100%). 183 pupils scored 8 or more. 98 pupils scored 12 or more. 7 pupils scored 4 or less.

Most common errors:

1. receipt - 90% of the students missed this word. Common spellings were receit, reciet and reseat.
2. numerator - 76% erred by spelling this word numerater or numorater.
3. height - 72% spelled this word as hight, hieght or hiet.
4. recipe - 68% spelled this word as receit or resipy.
5. thermometer - 54% spelled this word as thermometere, thermameter or thermeter.
6. account - 48% erred; usually the spelling was acount.
7. temperature - 44% misspelled this word as temperachure or temperture.
8. decimal - 36% erred; the usual error was to leave out i.

NUMBER SYSTEM.

7 marks were allocated to the second section of the test on interpretation of Decimal Numbers. The average score - 3.08.

16 scored 7	23 scored 5	37 scored 3	18 scored 1
19 scored 6	30 scored 4	13 scored 2	44 scored 0

Description of Errors:

1. Wrote a Common Fraction.
   17 6/10. 12% erred in this type.
2. Put a decimal point in front of the whole numbers.
   .10 1/10. 4% made this error.
3. Put in decimal point and wrote the fraction as a common one
   17.6/10. 48 pupils (24%) made this error.
4. Put decimal point in the wrong place.
   176. 1044. 12% erred in this respect.

5. Confused tenths and hundredths.

.04 for four tenths. 4% made this error.

6. Neglected decimal point. Did not understand counting each way from the decimal point in Question 4.

the 9 means hundreds.

the 6 means tens.

This was the source of greatest error. 61% erred.

LANGUAGE.

1 question on Fahrenheit scales and freezing point of water and 3 questions on the relationship of remainder and quotient to each other comprised this section of the test for an allocation of 4 marks. The average score was 1.39. The mode was 1.

3 pupils scored 4 (100%) 68 pupils scored 2 (50%)

8 pupils scored 3 (75%) 106 pupils scored 1 (25%)

15 pupils scored 0.

Classification of Errors:

1. 56% of pupils wrote that the quotient is larger than the divisor in Question 1.

40% of pupils said the quotient would be smaller.

2. Only 4% erred in Question 2 and wrote larger.

3. 12% of pupils wrote larger in answer to Question 3; 76% . 76% however wrote that the remainder is smaller than the quotient.

4. 52% wrote warmer as an answer to Question 4; that 23 degrees F. was warmer than the temperature of freezing water.

DENOMINATE NUMBERS.

Principles tested:	Question Number
Weights of Grains	1, 2 and 3
Boiling point on Fahrenheit scale	4.
Scale drawing	5
mile -- yd. relationship	6
rod -- yd. relationship	7

Denominate lengths:

calculated smaller form_____8 and 9
calculated higher form_____10.

Total score was 12; 3 marks were allotted to the last question.

11 pupils scored 12 (100%).143 pupils scored 6 or more. 62 pupils scored 9 or more. 17 pupils scored 3 or less. The average score was 7.14; the mode was 10.

Types of Errors:

1. 32% of pupils did not know the weight of a bushel of oats. 10% did not know wheat, and 8% did not know weight of potatoes.
2. Errors in calculation accounted for mistakes with 16% of pupils.
3. Weakness of Tables in Denominate Numbers.
   32% of pupils did not have a good grasp of the tables.
4. 48% did not know the Fahrenheit reading for boiling water.
5. The most common error in Question 5 was to measure both lines. Only 3% of pupils missed this question.
6. 44% of students erred in giving the answer to Question 6. Most of them did not know the number of yds.in 1 mi.

FRACTIONS.

37 marks were allotted for the 19 questions that comprised the last section of the Part A Test.

Principles tested:	Question Numbers
Relation of ½ and ¼ and	12
1/3 and 1/9	13
Addition of:	
Like fractions	6
Unlike fractions	12,14, 17 and 18
Mixed fractions	
(a)with same denominators	7, 8 and 9.
Subtraction of:	
Unlike fractions	15,16 and 19.
Mixed numbers (like fractions)	10
Knowledge of:	
Proper Fractions	3 (a)
Improper Fractions	3 (b)
Mixed Numbers	3 (c), 5.
Scale Plan (involving Fractions)	11.

The arithmetic mean for fractions by score was 23.5 or 63.6%. The mode was 25.

1 student scored 37 (full mark).

68 students scored 28 or more.

146 students scored 19 or more.

7 students scored 9 or less.

Types of Errors:

1. Lack of knowledge of proper and improper fractions.

20% showed inability to distinguish improper fractions from mixed numbers.

8% showed inability to distinguish proper fractions from improper fractions.

2. Failure to understand common denominator principle.

(a) Uses larger denominator as common one.

$\frac{3}{4}$ plus 5/6 - 8/6. 5/12 minus $\frac{1}{4}$ - 4/12.

$\frac{1}{2}$ plus 5/6 equals 6/6 or 1.

16% erred in this type.

(b) Adds Denominators.

$\frac{3}{4}$ plus 5/6 equals 8/10.

8% showed this type of error.

3. Adds with minus sign.

3/5 minus $\frac{1}{2}$ equals 11/10.

12% erred in this respect.

4. Errors in calculation were shown by 32%.

5. 60% were unable to interpret Question 11 regarding the dimensions of the plan for the house.

6. Marking a fractional part of the circles in Question 1 baffled many; about 30% erred in marking 2/3 of the circle by marking in $\frac{3}{4}$ of it. That was done by many students who had correctly indicated $\frac{3}{4}$ of the second circle.

7. About 4% of the pupils failed to reduce their fractions to lowest terms.

4.1	4.1
3. 7	3.7
8.6	8.6
1.64	15.14

The second of these errors was more common. The student kept his sum of tenths separate and does not understand 'carrying' 10 of the tenths and leaving the .4.

6% erred in decimals.

SUBTRACTION.

Decimals, dollars and cents, and numbers 6 digits wide comprised the eight examples on this section of the test for a total allocation of 8 marks.

75 scored 8 marks. 179 scored 4 or more.

151 scored 6 or more. 9 scored 2 or less.

Types of Errors:

1. Weakness in combinations was manifested by 18%.
2. Borrowing without making allowance was an error of 12% of the pupils.
3. Decimal point difficulties.
   (a) Wrong placing of point.

   20.0
   7.2
   1.28

   2% erred.
4. 6% of pupils added instead of subtracting.

MULTIPLICATION.

The 6 examples on this section of the test included multiplication of 3 digit numbers by 2 digit number and 3 digit multipliers.

Dollars and cents questions also were represented.

The mode was 5.

29 pupils scored 6 (full mark) 39 pupils scored 4

47 pupils scored 5 31 pupils scored 3

24 pupils scored 2 9 pupils scored 0

21 pupils scored 1

Classes of Errors:

1. Weakness in combination.

22% showed weakness in use of multiplication tables.

2. 10% ignored the dollar sign and decimal point.

3. 32% erred in the examples with 3 digit multipliers; most of the errors were weaknesses in multiplication tables over and above those listed under Error No.1 above. There were more mistakes in adding the numbers too, but it was difficult to determine the percentage of errors due to this as work was commonly not shown.

DIVISION

14 marks were allocated to this last section of the Part B test. 3 digit divisors were included in the group of problems.

The average mark for division was 7.36 or 52.5%.

The mode was 2.

13 pupils scored 14 (full mark) 119 pupils scored 7 or more.

74 pupils scored 11 or more 76 pupils scored 4 or less.

Classes of Errors:

1. Zero difficulty.

8% erred in this. $20\overline{)160}$ $\quad 80$

2. Errors in Subtraction:

30% erred in the remainder of incorrect subtraction.

3. Putting remainder after the quotient with a minus.

$75\overline{)674}$ $\quad 8-74$ 18% had this error type.

4. Left off zero in quotient.

$436\overline{)30733}$ $\quad 7\ 213/436$

14% neglected to put down the zero in quotient in the second division trial.

5. Three digit divisors caused considerable trouble. 30% made errors in this group of exercises alone. Work was seldom shown.

PART C.

Fourteen problems constituted this section of the test with 3 marks allotted to each of the first ten questions and one each to the last four questions, making 34 as a total.

Fractions, scale drawings, square measure, averages and problems involving the four operations were all on the section. There was more demand for reasoning on the part of the pupil in analysis of situations. Careful reading was needed and apparently was lacking in many cases.

0 pupil scored 34 (full mark).

13 pupils scored 25 or more.

64 pupils scored 17 or more.

43 pupils scored 8 or less.

The mode was 11.

Distribution of Failures: 200 students.

No. of Questions	1	2	3	4	5	6	7	8	9	10	11	12	13	14
No. failing to do problem	112	66	42	122	156	122	140	102	150	130	44	56	62	108

Discussion of Error Types:

Question 1. The answer here was usually 9; few students counted the $\frac{1}{4}$, although some wrote 9 and 8 over. The idea of averages was better than in Grade IV.

Question 2. Students nearly all said the 65 books would cost more, but it usually developed that they compared that price of 55¢ to the 40¢ price in the first situation. This however was one of the easier questions for most of the students, 67% getting a correct response.

Question 3. Here was a simple subtraction problem with Unit fractions; only 21% failed to make the correct response. Some of these made mistakes in subtraction.

$40\frac{1}{2} - 26\frac{1}{4}$ equals $16\frac{1}{4}$; this was an error of

subtracting 6 from 0 is 6.

Question 4. Response was poorer; 61% made mistakes; many of these appeared to be from wrong remainders in the division. Work was not usually shown. Others put 15 hrs. and ignored the remainder; the others usually said 15 hr., 21 minutes instead of writing 21/48 hr.

Question 5. This was a question on scale-drawing. Very few analyzed it correctly. A large number multiplied $2\frac{1}{2}$ times 250. Even those who sensed $2\frac{1}{2}$ in equal 250 miles did not show they must get the equivalent for unit inches. 78% missed the proper interpretation.

Question 6. 61% of the students failed to change the pounds of wheat to bushels before multiplying by the given price per bushel; a few of the group did try to make the change but erred in the calculation.

Question 7. There was more money turned in by the girls, so nearly everyone put down girls as an answer. 70% of the students did not understand the idea of average because they proceeded to subtract the $125.32 (boys' gross sale) from the $180.54 (girls' gross sale). Thus the usual answer was $55.22

Question 8. This was a question of equivalent fractions, but many students interpreted as meaning an increase in the value of the fraction.

Question 9. 75% of the students failed to understand considering 20 pounds as a fractional part of the total weight of 50 lbs. The usual error was to compare the 20 lb. to the remaining 30 lb. and give an answer of 2/3.

Question 10. This involved area in acres of a piece of

land 1 mile by 2 miles. 65% of the pupils did not know the relationship of acres to square miles. The answers were varied; many wrote 2 acres - product of 2 and 1; others added 1 plus 2. Many had 1920 acres which represented addition of the dimensions and then multiplying 640. These students were not clear about how to find area.

Question 11. Many did not know meaning of included and so did not count Sunday, answer given was $15.00 (6 x $2.50). Others made the mistakes in multiplying by 7. The total group making errors was 22% of the whole number.

Question 12. The usual error here was a faulty calculation of the number of pints in a gallon. Most confused quarts with it and multiplied by 4 giving an answer of 80¢. 56 students or 28% erred.

Question 13. Most students realized that one would go 60 times as far in sixty times as long, but some merely wrote 60 as an answer. Others made a mistake saying 60 x 20 is 120.

Question 14. The common answer was 2¢. However many out of the 108 students who erred in this question wrote 8¢; - apparently they divided 16 into 24 and wrote the remainder as an answer.

On the whole the problem section indicated that the pupils had not re-read the questions to clarify the nature of the question. Most of the errors arose from starting out with a misunderstanding of what was wanted. There is much problem work recommended for the Grade V course in arithmetic and every care needs to be taken to see that a critical sense of analysis is developed. It is assumed that a student should have mastered the fundamental operations and main facts regarding denominate relationships.

CHAPTER VIII

GRADE VI

The test paper in Grade VI consisted of three sections;- Part A, Part B, and Part C. The total score on the paper was 131.

The average established as an arithmetic mean was 68.06 or 51.9%.

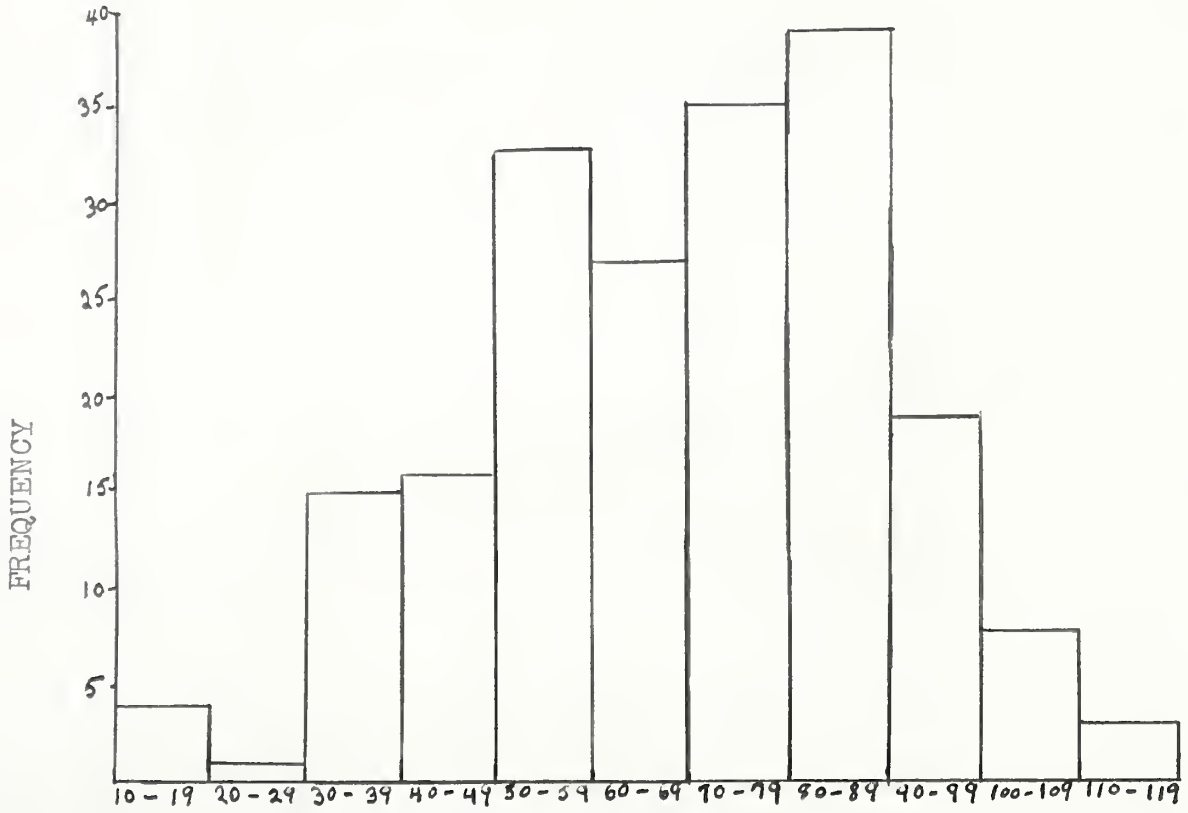
200 papers were marked for which the median was 69.5

The First Quartile was 53.8 ; The Second Quartile was 83.6

TABLE XVI

FREQUENCY DISTRIBUTION OF TOTAL SCORES

No.of Cases	Score	No.of Cases	Score	No.of Cases	Score	No.of Cases	Score	No.of Cases	Score
1	10	2	42	2	60	2	75	2	92
1	11	1	45	2	61	2	76	1	93
1	15	1	47	1	62	2	77	3	94
1	19	2	48	5	63	5	79	3	95
1	22	3	49	3	64	9	80	4	96
1	30	2	50	6	65	4	81	3	97
2	31	2	51	2	66	1	82	1	100
1	32	2	52	1	67	3	83	1	101
1	34	1	53	3	68	5	84	1	104
3	35	6	54	2	69	4	85	1	105
4	36	4	55	6	70	4	86	3	106
1	37	4	56	7	71	4	87	1	108
2	39	2	57	3	72	3	88	1	110
3	40	4	58	3	73	2	89	1	113
4	41	6	59	5	74	3	91	1	115



Scores (class Interval - 10)

Class	Frequency
10 - 19	4
20 - 29	1
30 - 39	15
40 - 49	16
50 - 59	33
60 - 69	27
70 - 79	35
80 - 89	39
90 - 99	19
100 - 109	8
110 - 119	3
Total	200

Fig. 9. - Frequency distribution of scores.

TABLE XVII

CLASSIFICATION OF AVERAGE SCORES BY AGE GROUPS AND SEX

Age Classes in years		No.	Average Score
10½ - 11	Boys	-	-
	Girls	2	59.5
11 - 11½	Boys	5	84.5
	Girls	13	73.5
11½ - 12	Boys	6	82. 8
	Girls	9	82. 7
12 - 12½	Boys	23	72. 9
	Girls	30	67. 7
12½ - 13	Boys	13	71.5
	Girls	11	71.4
13 - 13½	Boys	24	69.0
	Girls	19	74.3
13½ - 14	Boys	7	61.7
	Girls	3	69.3
14 - 14½	Boys	7	56.1
	Girls	10	43.6
14½ - 15	Boys	5	48.0
	Girls	1	57.0
15 - 15½	Boys	3	38.3
	Girls	5	42.2
15½ - 16	Boys	1	42.0
	Girls	1	63.0
16 - 16½	Boys	2	85.5
	Girls	-	-

In the above table it is significant that the best average scores were made in the agegroups from 11- 13½ years.

TABLE XVIII

CLASSIFICATION BY SEX

Sex	No.	Aggregate	Average Mark (Score)	Average Mark (%)
Boys	96	6591	68.6	52.3
Girls	104	7021	67.5	51.6
Total	200	13612	68.06	51.9

There is no significant difference between the achievements of the boys and of the girls on the test.

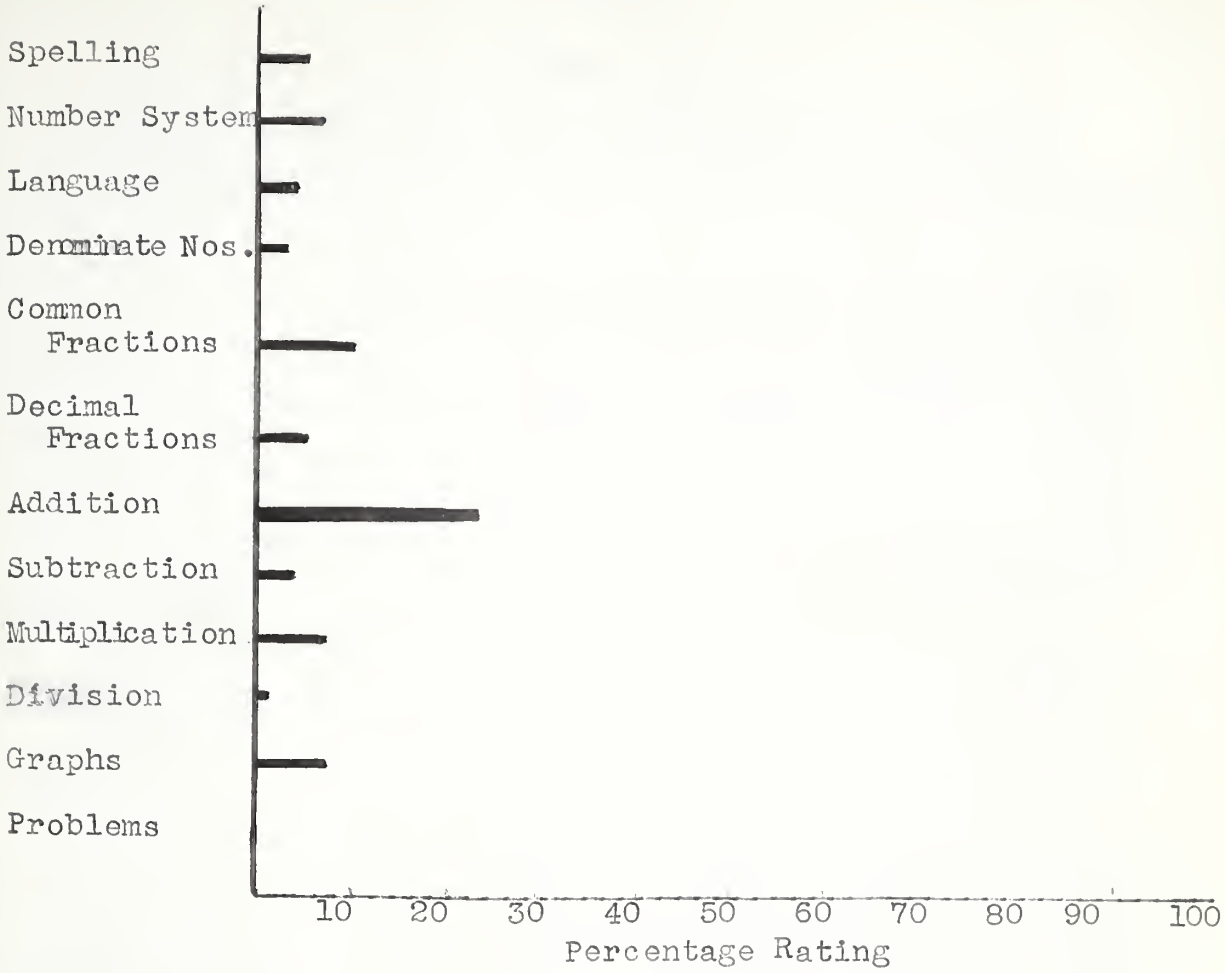


Fig. 10.- Percentage of answers scored correct in each section of the Grade VI test.

TABLE XIX

NORMS FOR EACH SECTION OF THE GRADE VI TEST

	Possible Score	75 % of Pupils Scored above	50% of Pupils Scored above	25% of Pupils Scored above
Spelling	12	7	8	10
Number System	7	2	4	5
Language	5	0	1	2
Denominate Nos	6	0	2	3
Common Fractions	10	4	6	7
Decimal Fractions	13	5	8	10
Addition	8	4	6	7
Subtraction	10	3	6	7
Multiplication	9	4	5	6
Division	8	1	3	4
Graphs	10	2	5	7
Problems	33	1	8	14
Total	131	54	69	83

TABLE XX

AGGREGATES AND AVERAGES IN EACH SECTION OF THE TEST

	Possible Mark	Possible Aggregate	Actual Aggregate	Average Mark (Score)	Average Mark %
Spelling	12	2400	1776	8.88	74.0
Number System	7	1400	868	4.39	52.7
Language	5	1000	318	1.59	31.8
Denominate Nos.	6	1200	492	2.46	41.0
Common Fractions	10	2000	1336	6.68	66.8
Decimal Fractions	13	2600	1603	8.01	61.6
Addition	8	1600	1241	6.20	77.1
Subtraction	10	2000	1234	6.17	61.7
Multiplication	9	1800	1156	5.78	64.2
Division	8	1600	689	3.44	43.0
Graphs	10	2000	1064	5.32	53.2
Problems	33	6600	1883	9.41	28.5

The above table indicates the possible score and aggregate as well as the actual aggregate and arithmetic means established in each of the sections of the Grade VI test by 200 pupils.

PART A

The test for Grade VI consisted of Parts A, B, and C with a total score of 131. Part A consisted of six sections- Spelling, Number System, Language, Donominate Numbers, Common Fractions, and Decimal Fractions.

SPELLING

This section represented 12 words written from dictation; all the words belong to the vocabulary of the Grade VI course in arithmetic. The total score was 12. Average score was 8.88 or 74%. The mode was 10.

11 scored 12 marks (100%)
131 scored 9 or more
187 scored 6 or more
4 scored 3 or less.

Common Errors:

1. Column - this was misspelled most frequently; 90% erred by writing colume, colum, or collum.
2. Compasses - 89% misspelled this word. Compases, compasess, and compasis were typical of errors.
3. Longitude - 68% erred
4. Hundredth - 44% erred; the usual error was to omit the second 'd'.
5. Cube - was misspelled by 40% of the pupils.

NUMBER SYSTEM

7 questions comprised this section of the test. The total score for the section was 7. All questions involved the interpretation of decimals.

18 pupils scored 7 (100%)
98 pupils scored 5 or more
133 pupils scored 4 or more
33 pupils scored 2 or less

The mode was 6. The average score was 4.39 or 62.7%

Description of Errors:

1. 40% of students showed in Question 1 an inability to distinguish tenths from hundredths. The usual answer was 2 hundredths. Some wrote 2 tens; a few wrote $\frac{1}{2}$.
2. 56% failed to distinguish between .1 and .01 in Question 4.
3. 16% said .7 is more nearly equal to 1 than 1.2.
4. 8% failed to give a corredt answer for Question 5 and also for Question 6. Common error for Question 6 was 15.24 in unfamiliarity with the decimal number system.
5. Question 7 - 28% erred in this question.

Errors varied:
(a) 10 7/10 (b) 107.3 (c) 10.10

Each type of error indicates a certain train of thought. The (c) error was obtained by adding together the 7 and 3 of the example 10.73.

LANGUAGE

Four questions with an allotted score of 5 comprised this section.

4 pupils scored 5.	47 pupils scored 2,
16 pupils scored 4.	59 pupils scored 1.
27 pupils scored 3.	47 pupils scored 0.

Errors:

1. In Question 1, two types of errors appeared.
   (a) 22% wrote 4% equal $\frac{1}{4}$.
   (b) 21% wrote 4% equal .4.
2. 64% erred in Question 2. The usual error was to use 12 or 144 instead of 1728 when the students were not familiar enough with the tables of volume. 12% of the students said to multiply instead of dividing. A large number did not state any number - just said "divide
3. 20% erred in Question 3; usually the decimal point was put in the wrong place.
4. In Question 4 two errors occurred.
   (a) 28% did not know number of sections in a township.
   (b) 16% did not notice that question said 100

quarter sections and they calculated on basis of 100 sections, giving an answer of 64.

DENOMINATE NUMBERS

Principles tested:

cu. ft. - cu. in. relation

cu. yd. - cu. ft. relation

rod - foot relation

sq. rd. sq. yd. relation

degrees of a right angle

Longitude

6 Questions were given with allocation of 1 each.

7 pupils scored 6

24 pupils scored 5 or more

98 pupils scored 3 or more

102 pupils scored 2 or less.

Average was 2.46 . Mode was 3.

Errors:

1. Weakness in tables.

   28% of pupils could be classed as simply not knowing the relationships involved in the first four questions.

2. 64% gave lineal relationships in Questions 1 and 2.

   1 cu. ft. equal 12 cu. in.

   1 cu. yd. equal 3 cu. ft.

3. 24% made a mistake in the square measure here by stating 5½.

   A few put 121, which was a part of the $\frac{121}{4}$ often used in calculations as $30\frac{1}{4}$ equal $\frac{121}{4}$.

4. 12% gave either 30 degrees or 1 degree for a right angle.

5. 8% erred in Question 6 by subtracting 70 degrees W. - 10 degrees E. equal 60 degrees.

COMMON FRACTIONS

The total score allotted this section was 10.

18 scored 10 (100%)

75 scored 8 or more

154 scored 5 or more

30 scored 3 or less .

The average was 6.68. The mode was 8.

Classification of Errors:

1. 72% erred in procedures for simplifying in Questions 1 and 2. This was the greatest example of error.
2. 4% added when minus sign indicated.

   $\frac{3}{4}$ - 5/12 equal 14/12 equal 1 1/6
3. Added denominators and numerators.

   9/10 plus 3/5 equal 12/15.

   4% erred in this type.
4. Did not use a common factor for reducing to lowest terms.

   54/63 equal 27/31½

   10% erred in this.
5. Multiplied for reduction to lowest terms.

   54/63 equal 3402 6/8 x 4

   4% erred in this.
6. Multiplied numerator by denominator in multiplication of fractions.

   6/8 x 4/9 equal 1728

   6x4 equal 24; 8x9 equal 72; 24x72 equal 1728

   3% showed this type of error.

DECIMAL FRACTIONS

This section consisted of four types of exercises:

1. Expressing decimals as mixed numbers.
2. Expressing mixed numbers as decimals.
3. Placing decimal points in products.

4. Product of 2 decimal numbers to nearest tenth.

The total score allotted was 13.

9 scored 13.

76 scored 10 or more.

135 scored 7 or more.

39 scored 4 or less.

Errors:

1. Ignorance of a mixed number. Type 1 principle.

3.6 equal 3/6 2.25 equal 2/25

12% erred in this.

Others wrote improper fractions.

3.6 equal 36/10

8% showed this error.

2. Difficulty in changing a common fraction to a decimal - Shown in Type 2 principle.

2 1/5 equal 2.5

2 1/5 equal 2.15

2/25 equal 2.25

10% erred in this respect.

3. Incorredt placing of decimal point in the product -- Type 3 principle

0.9 x 0.7 equal 63.00

0.62 x 100 equal 62.

1.9 x 2.4 equal 45.6

12% erred in the first 2 examples given; but

48% erred in the last one, 0.62 x 100.

4. Question 4 -12% erred by wrong calculation.

36% erred by misunderstanding what was wanted.

5. 20% of pupils did not reduce answers to lowest terms.

.6 equal 3 6/10 (3 3/5).

PART B

This second part of the Grade VI test consisted of exercises in the four fundamental operations.

ADDITION

8 questions representing column addition, fractions, denominate relationships, and decimals comprised the addition test for a total allocation of 8 marks.

43 pupils scored 8.

138 pupils scored 6 or more.

189 pupils scored 4 or more.

3 pupils scored 2 or less.

Classes of Errors:

1. Weakness in combinations - 16 % erred.
2. Failure to take minutes to higher denominations

   21 hr. - 91 min.

   16% neglected this.
3. Difficulty in mixed fractions

   (a) no common denominator

   17 2/3 plus 4 3/4 equal 22 1/4 -- 12% erred.

   (b) mistakes in calculation. -- 8% erred.

   (c) multiplied the fractions -- 4% erred.

   9½ plus 2 3/5 equals 19/2 x 13/5 equals 247/ 10 equals 24 7/10.
4. Expressing a mixed number.

   Question No. 8.

   $\frac{16 \text{ plus } 18 \text{ plus } 12 \text{ plus } 15}{24}$ equals 61/24 equals 2 13/61.

   8% failed to change the improper fraction to the correct mixed number.

SUBTRACTION

Decimals, denominate tables, fractions, and mixed numbers comprised the 10 questions of this section of the test.

8 pupils scored 10.

71 pupils scored 8 or more.

150 pupils scored 6 or more.

33 pupils scored 3 or less.

The mode is 8; the average is 6.17.

Errors were varied:

1. 16% erred in combinations.

2. Borrowing Difficulties.

(a) in denominate tables - 8% erred.

gal	qt.
17	1
12	3
4	8 equal 6 gal.

Student borrowed 1 gal. but did not change it to qt. and combine with 1.

(b) Zero missing in minuend - 2% erred.

36.6	36.6
5.92	5.92
30.69	30.79

Pupil borrows from the 6 but subtracts 2 from 11 rather than 10 and puts down 2.

(c) Borrowed without allowing - 8% erred.

36.6
5.92
30.78

Pupils take 9 from 16; but he had only a 5 where he assumes a 6.

3. Added when minus sign shown.

$\frac{1}{2}$ - 3/7 equal 13/14.

10% erred by adding thus.

4. Keeps each subtraction process on each side of decimal point.

49.24
13.8
26.16

Student subtracts 8 from 24 and writes down 16 without regard for decimal.

2% showed this misunderstanding.

5. - Subtracted without a common denominator.

5/8-3/12 equal 2/12

1% erred in this regard.

MULTIPLICATION

9 questions, representing mixed numbers, decimals, denominate numbers, and 4 digit multiplicands, comprised this section of the Part B test.

Full score was 9.

14 pupils scored 9.

86 pupils scored 7 or more.

150 pupils scored 5 or more.

33 pupils scored 3 or less.

The mose was 7.

Difficulties:

1. 28 % erred in calculation through weakness in multiplication tables.

2. 4% did not take answer in Question 3 to higher denominations.

45 cwt. equal 156 lb.

3. 12% erred in calculation of fractions.

(a) added.

4 1/5 X 1 4/5 equal 6

(b) cancells out a denominator from a mixed number.

1 7/8 x 8/15 equal 1 7/15

4. Faulty application of rule for decimal point in the product.

6.24 x 0.8 equal 49.92.

0.17 x 0.19 equal 3.23.

20% erred in this type. The heavier error was in the second example.

DIVISION

8 marks was allocated as the score for the 8 questions in division.

Types of Problems:	Question No.
1. Long Division	
4-digit dividend	1
6-digit dividend, 3 digit	2
2. Division of Mixed Number By a Mixed Number	3 and 4
3. Division with decimals	5, 6 and 7
4, Division of Denominate set	8

2 pupils scored 8 marks (100%)

30 pupils scored 6 or more

141 pupils scored 4 or more.

63 pupils scored 2 or less.

Average was 3.44 or 43%; Mode was 3.

Errors:

1. 40% made mistakes in calculation in the long division - Weakness in multiplication tables was chief cause.

2. 32% erred in placing remainder after a minus sign.

$$38\overline{)9628}\quad \frac{253 - 14}{}$$

3. 4% did not invert the fractional divisor

3 3/5 by 1 1/5 equal 18/5 X 6/5.

4. 4% did not change mixed numbers to improper fractions for division.

5. 36% failed to place decimal point in proper place in quotient.

$$42\overline{)35.2}\quad \frac{8.38}{}$$

6. 10% did not complete division in decimals

$$42\overline{)35.8}\quad \frac{.8\ 16/42 \text{ equal } 8/21}{}$$

7. 75% erred in Question 8.

$$12\overline{)25\text{ gal. }2\text{qt.}}\quad \frac{2\text{ gal. }1\text{ qt.}}{}$$

Pupils failed to carry extra gal. to qt., and combine for 6 qts. to be divided by 12.

PART C

The Part C of the test had 2 questions - one on Graph interpretation and another section on problems.

GRAPHS

Here were two questions - one of reading from the graph certain elevations indicated by bars; then there was plotting elevators by bars on the same diagram. 5 marks was allotted to each section.

The mode was 7. The average was 5.32.

13 scored 10 (full mark)

53 scored 8 or more.

124 scored 5 or more.

56 scored 3 or less.

24% of the students erred in reading the representations in Question 1.

38% erred in drawing bars on the diagram to represent elevations.

Many did not try the second section.

PROBLEMS

Ten problems comprised the last section of the Part C test. Question 5 received 3 marks for each part, thus the total score for problems was 33. The mode was 12.

The average for problems was 9.41 or 25.5%.

0 students scored full marks.

4 students scored 25 or more.

37 students scored 17 or more.

110 students scored 9 or more.

33 students scored 0.

Discussion of Problem Difficulties:

Question 1. 74% failed to express understanding of what was wanted, most students who did not read carefully tried to subtract though the answer to the subtraction was often $1\frac{1}{4}$. A very large number made mistakes in

manipulating the mixed numbers.

Question 2. This question involved division of 60¢ by a mixed number and multiplying the quotient by a mixed number. There is no work shown to account for the great variety of answers. 68% erred in doing the question. Many wrote 40¢ as if an estimate were in their minds.

Question 3. The usual error arose from not changing the 10 inches to feet. This was one of the heaviest failures on the section. 88% failed to get the question. A few added the dimensions.

Question 4. 50% did not get this question. Many divided instead of multiplying. A few made errors in calculation. A large number did not try the exercise.

Question 5. Those who missed the first part of the question usually made a mistake in placing the decimal point. A much larger group failed to calculate the number of square feet for the second part of the question; thus a common answer here was 19.125 lb. In many cases the answer 18.275.lb. appeared. 60% failed to do the problem.

Question 6. The chief error lay in not changing the sq. ft. to sq. yds. 58% erred in this question. Many errors were made by calculating perimeter instead of area.

Question 7. 2 types of errors occurred; many thought of time at Ottawa as being earlier and so put 9 o'clock instead of 3 p. m. A very large group did not try this question. Many others thought there was one degree short of the 45 difference and so only a difference of 2 hours and wrote 2 p. m. as the answer.

74% erred on the question.

Question 8. 62% erred on calculating the area by simply multiplying the dimensions given.

Question 9. 54% erred on this question. There were many varieties of answers. Many expressed the answer as a common fraction,- 15/50 or 3/10. Others wrote 50 - 35 equal 15%.

Question 10. The common answer was a 1/3 or 33 1/3%. 78% of the students erred; chief cause seems to have been thoughtless reading that resulted in finding the fractional part 20 was of 60.

CHAPTER IX

GRADE VII

The test paper in Grade VII consisted of two sections, Part A and Part B with a total score of 106.

The median score was 49.1

Q_1 was 39.7 ; Q_3 was 61.2

The arithmetic mean was 50.43 or 47%.

The average time for writing the test was 3 hours and 21 minutes for the two sittings of Part A and Part B.

TABLE XXI

FREQUENCY DISTRIBUTION OF TOTAL SCORES

No.of Cases	Score	No.of Cases	Score	No.of Cases	Score	No.of Cases	Score
1	17	5	37	5	52	1	67
1	20	7	38	2	53	4	68
1	23	4	39	5	54	3	70
1	24	5	40	4	55	4	71
2	25	9	41	5	56	4	73
3	26	6	42	4	57	1	74
2	27	7	43	5	58	1	75
2	28	6	44	1	59	1	76
3	29	5	45	2	60	3	77
2	31	6	46	2	61	3	79
4	32	3	47	4	62	3	82
1	33	3	48	5	63	1	83
5	34	4	49	4	64	1	87
2	35	6	50	3	65	1	88
2	36	7	51	2	66	1	90

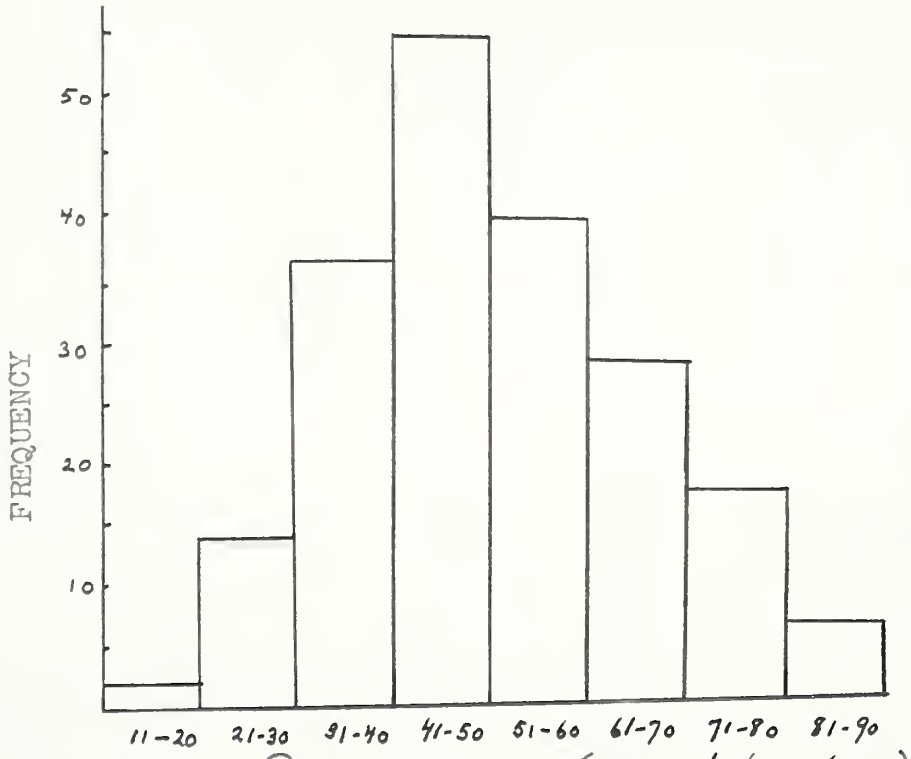


Fig. 11 — Frequency Distribution of Total Scores

Class	Frequency
11 - 20	2
21 - 30	14
31 - 40	37
41 - 50	55
51 - 60	40
61 - 70	28
71 - 80	17
81 - 90	47

Total - 200

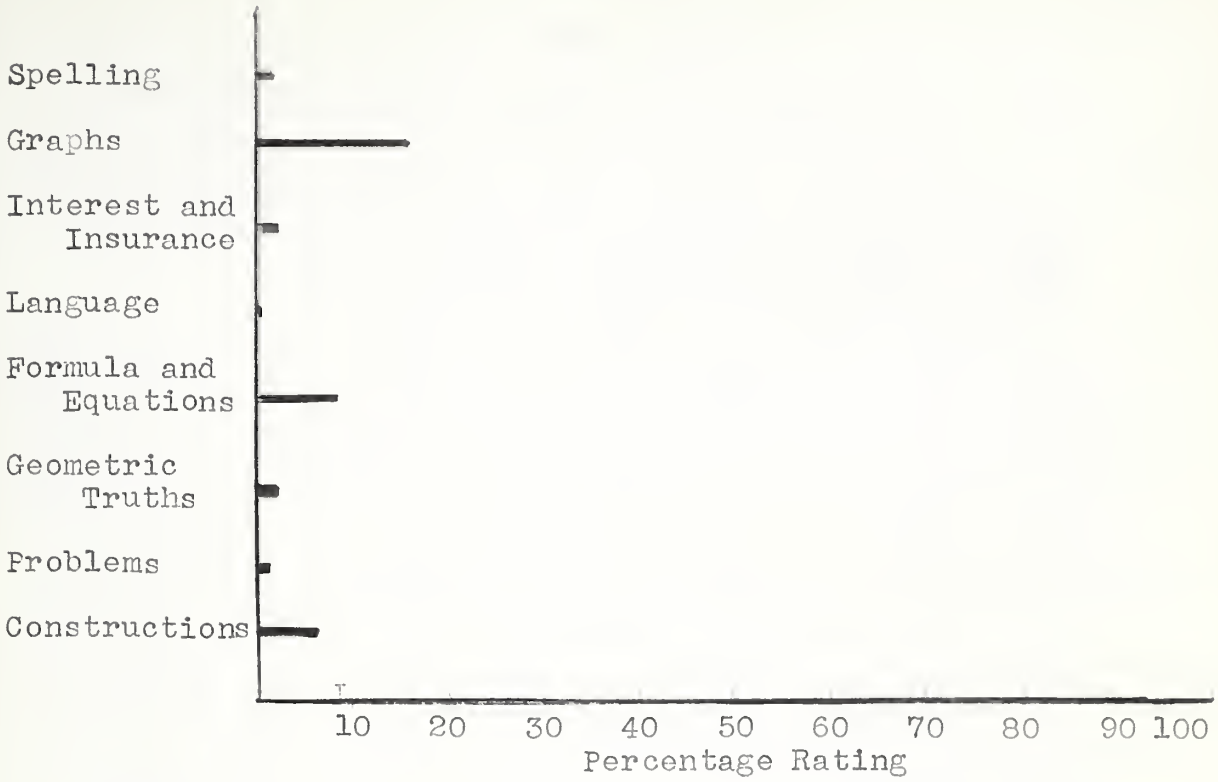


Fig. 12.- Percentage of answers scored correct in each section of the Grade VII test.

TABLE XXII

NORMS FOR EACH SECTION OF THE GRADE VII TEST

	Possible Score on Test	75 % of Pupils scored above	50 % of Pupils scored above	25 % of Pupils scored above
Spelling	33	21	24	27
Graphs	17	0	9	13
Interest and Insurance	10	1	3	5
Language	15	0	2	4
Formula and Equations	8	1	3	5
Geometric Truths	8	1	1	2
Problems	5	0	0	1
Constructions	10	1	2	5
Total	106	39	48	61

TABLE XXIII

AGGREGATES AND AVERAGES FOR EACH SECTION OF THE TEST

	Possible Mark	Possible Aggregate	Actual Aggregate	Average Mark Score	Average Mark %
Spelling	33	6600	4855	24.27	73.5
Graphs	17	3400	1619	8.09	47.5
Interest and Insurance	10	2000	787	3.93	39.3
Language	15	3000	648	3.24	21.6
Formula and Equations	8	1600	728	3.64	45.8
Geometric Truths	8	1600	476	2.38	29.7
Problems	5	1000	137	.68	13.6
Constructions	10	2000	842	4.21	42.1
Total	106	21200	10087	50.43	47.5

The above table indicates the possible scores and aggregates as well as the actual aggregates and arithmetic means established by 200 pupils in each of the eight sections of the Grade VII test.

The test paper was in 2 sections, Part A, Part B with 4 sections in each part.

Total score was 106.

PART A

Spelling, Graphs, Insurance and Interest, and Language comprised the 4 sections of Part A of the test.

SPELLING

33 marks were allotted for 33 words written from dictation.

2 students scored 33

100 students scored 25 or more

179 students scored 17 or more

2 pupils scored 8 or less.

The average score was 24.27 or 73.5%.

Errors were common over the whole group.

Everyone spelled angle and standard.

The most common errors:

1. rhombus - 90% misspelled this word as rhombuse or rombus.
2. isosceles - misspelled by 61%.
3. vertices - 65% erred.
4. oblique - 48% misspelled this word.
5. parallel - 36% erred.
6. concentric
   arc
   algebra
   horizontal - 28% erred on each of these words.
7. transversal - 24% erred on this word.

GRAPHS

A circle graph valued at 5 marks and a line graph with an allocation of 12 marks comprised this section. The mode was 0. The line graph had to be completed to get any credit.

32 pupils scored 17 (full mark)

54 pupils scored 13 or more.

104 pupils scored 9 or more.

72 pupils scored 5 or less.

57 pupils scored 0.

The most common error in the first graph was carelessness in constructing the figure; a protractor had to be used with accuracy. However 32% of the pupils did not have a proper idea of what was wanted.

In the second question 30% of the pupils drew bar graphs. Some joined the tops with a line. Many wrote the temperatures along the bottom of the figure instead of the side as indicated.

INSURANCE AND INTEREST

2 problems on insurance and eight blanks in a table on interest constituted this section. Full value was 10 marks.

1 pupil scored 10.

27 pupils scored 8 or more.

72 pupils scored 5 or more.

94 pupils scored 3 or less.

The average was 3.93 or 39.3%; the mode was 4.

Classes of Errors:

1. Neglected decimal point in use of percentage.

   80% of $6000. equal $4800.

   ¼% of $4800. equal $1200.

   36% erred in this.

2. In Question 2, the pupils multiplied by 3 the answer obtained in Question 1.

   $12. x 3 equal $36.

   14% erred in this.

3. Poor calculation was made by 61%.

   3% of $850. equal $26.50

4. Failure to understand what was wanted in Question 2.

(a) Student did not take 80% of $6000.

$70.x$60. equal $42.00 1/3 of $42.00 equal $14.

(b) Student did not figure annual rate.

$48. x $70. equal $33.60

31% failed to read the question correctly.

5. In Question 3

(a) Calculated interest for 1 yr.

$850. x 3% equal $25.50; amount $75.50

8% erred here.

(b) Added interest to amount to get principal

$240. plus $40. equal $280

4% erred in this.

(c) Misplacing of decimal point in calculation.

32% erred.

LANGUAGE

15 marks were allocated to the 15 questions.

The results were low; average score was 3.24 or 21.6%.

0 pupils scored 15.

2 pupils scored 12 or more.

13 pupils scored 8 or more.

139 pupils scored 4 or less.

The mode was 3.

Problems and Errors:

51% used X for multiplication

2XyXZ is product of 2, y and z.

Question 1 -

a. 4% multiplied.

b. 20% added numbers; multiplied letters.

10 abc.

c. 12% added numbers separately.

10 a plus b plus c

d. Ignored letters.

Added integers -10

6% erred in this.

Question 2 -

(a) 16% tried to subtract larger numerical quantity.

3y - 2x

(b) 12% subtracted 2x from 3y for am answer of 1xy

Or 1y.

Question 3 -

(a) a common answer was 2 X X3y

(b) 12% added.

Question 4.

(a) 40% wrote 12 ÷ 5y

(b) 8% wrote $\frac{5y}{12x}$ - interchanged dividend and divisor

(c) 8% divided 12 by 5 with an answer of 2 2/5.

Question 5. 28% erred; a common answer was x-1 or 2x - y

(1 more than x equal 2x).

Question 6. 72% erred.

(a) most common error was 10n.

Students did not understand index of squares.

(b) 31% added - 5n plus 2n equal 7n.

Question 7. 32% multiplied - $\frac{1}{2}$ ab.

8% leftout the brackets - $\frac{1}{2}$a plus b.

Question 8. 60% erred on the question.

32% wrote 6ab - 4 equal 2 ab

28% added numbers and subtracted the 4.

3a plus 2b equal 5ab.

5ab - 4 equal lab.

Question 9. 36% failed to do this question.

Product of 5 and a.

20% wrote 7 plus 5a equal 12a

16% wrote 5 x 7 x a equal 35a.

Question 10. Usual error was multiplication.

2 x r x 0

Question 11. Multiplied instead of dividing the perimeter.

40% wrote 4p.

Question 12 52% erred by not dividing by 100 to take the cents to dollars.

Question 13. 64% failed here; D plus C was usual answer.
cd¢ in some cases.
10dc in a few cases

Question 14. 24% failed by writing 2A plus B.
failure to use brackets; the dimensions
of inches usually was omitted.

Question 15. 28% erred by usually writing A - B.
Neglect of dollar sign and failure to use
brackets around the expression.

PART B

This section of the test consisted of 4 sections -- Formulae and equations, Geometric Truths, Problems and Constructions.

Formulae and Equations.

4 questions of each principle composed the first section. The total score was 8. The mode was 4.

18 pupils scored 8.

55 pupils scored 6 or more.

98 pupils scored 4 or more.

76 pupils scored 2 or less.

Problems and Errors;

1. The first three questions asked for the formula for the area of a parallelogram, a triangle and a circle.

   48% of pupils used an X for multiplication nprocess

   A equal a x b

   A equal $\frac{1}{2}$ x b x a.

2. 4% wrote as area of parallelogram

   A equal P

   It is not clear whether students meant perimeter or parallelogram.

   Several of the students put for area of triangle.

   A equal T

3. 16% had no idea of the correct formula.

4. Capital letters often used;

   A equal BA

5. In the equations:-

   (a) multiplied by denominator instead of subtracting.

   x plus $\frac{1}{2}$ equal 6

   x equal 12.

   8% erred in this type.

   (b) subtracted instead of multiplying.

$\frac{a}{3}$ equal 7 a equal 7 - 3
equal 4

4% erred in this.

GEOMETRIC TRUTHS

Five questions on relationship of figures were given 5 marks on the test.

1 pupil scored 8

4 pupils scored 6 or more.

21 pupils scored 8 or more.

126 pupils scored 2 or less.

Errors:

1. 55% showed inability to distinguish a rhombus from a parallelogram. Many said a parallelogram was longer or that a rhombus was one half a parallelogram.
2. Failure to compute areas.
   (a) 8% gave the answer 4/5
   compared radii
   (b) 4% gave the ratio in terms of the larger circle$\frac{3}{4}$
   5/4 or 1 1/4 times the smaller circle.
   (c) 4% stated $2\frac{1}{2}$ inches was $\frac{1}{2}$ inch greater than 2 inches.
   (d) 21% made errors in calculating the areas, in the arithmetical work.
3. In computing the third angle of a triangle:
   (a) 8% added the 2 given angles.
   (b) 4% subtracted.
   (c) 8% gave an answer of 80 degrees, indicative of poor calculation.

Nearly all students answered Question 3 correctly.

PROBLEMS

Total score was 5; the mode was 0.

1 pupil scored 4

7 pupils scored 3

23 pupils scored 2

64 pupils scored 1

105 pupils scored 0.

Errors:

1. Use of x sign for multiplication

   X x y x z cu. ft. 10% erred.

2. Failure to change cu. in. to cu. ft.

   Question 1 - xyz cu. ft.

   32% of pupils failed to divide by 1728.

3. In Question 2;

   (a) 8% divided loss by 2.

   $\frac{X - 3¢}{2}$

   (b) 16% confused loss with selling price.

   2 x 3¢ equal 6¢

   Poor reading indicated.

   (c) 12% failed to use brackets for expressions.

   2x - 3¢

   (d) 10% used x with no brackets.

   x - 3 X 2¢

4. In Question 3:

   8% divided the D dimes by 100 to get dollars.

   6% inverted and divided D into 10.

5. In Question 4:

   (a) 40% of pupils divided

   N hr. equal $\frac{N}{60}$ minutes.

   (b) 8% wrote 60 minutes.

6. In Question 5:

   8% multiplied by 12 $\frac{x}{2}$ in. equal 6 ft.

   8% wrote $\frac{x}{12}$

   4% wrote $\frac{x}{162}$ -- (no work shown)

   6% wrote 12x ft.

CONSTRUCTIONS

The exercises comprise Sheet 4 of the test as is indicated in the key. Though numbered as 6 to 10 inclusive under the problem section, they have been marked as a

separate section concerned with constructions.

The total mark allocated was 10.

6 pupils scored 10 marks.

26 pupils scored 8 or more.

73 pupils scored 5 or more.

167 scored 3 or less.

18 pupils scored 0.

Types of Errors:

1. 20 % erred in drawing the circle for the circular plot of ground by making a square.

   24% erred in the size of the circle through miscalculation.

2. 36% failed to draw a perpendicular to a line segment at a point in Question 7.

   (a) 20% obviously used a ruler on the rt. angled triangle.

   (b) 16% did not follow through the correct procedure.

3. 60% did not know the method of constructing one line parallel to a given one.

4. Most of the students drew another line wither with a ruler or a set of parallel rulers.

   Very few students failed to bisect the line or the given angle in Questions 9 and 10 respectively.

CHAPTER X

GRADE VIII

The Grade VIII test consisted of eight sections which were written in one sitting. The total score was 72. Two hundred papers were marked in this grade and the median score established was 26.3

Q_1 was 19.9; Q_3 was 32.4

The Arithmetical mean was a score 26.31 or 36.5%

The mode was 28.

TABLE XXIV

FREQUENCY DISTRIBUTION OF TOTAL SCORES

No.of Cases	Score	No.of Cases	Score	No.of Cases	Score	No.of Cases	Score
1	6	13	18	15	28	6	38
3	7	7	19	3	29	4	39
2	10	7	20	12	30	4	40
2	11	13	21	8	31	1	41
2	12	8	22	5	32	3	42
1	13	7	23	4	33	3	43
1	14	5	24	4	34	1	44
8	15	5	25	3	35	1	46
3	16	11	26	4	36	1	47
4	17	8	27	6	37	1	51

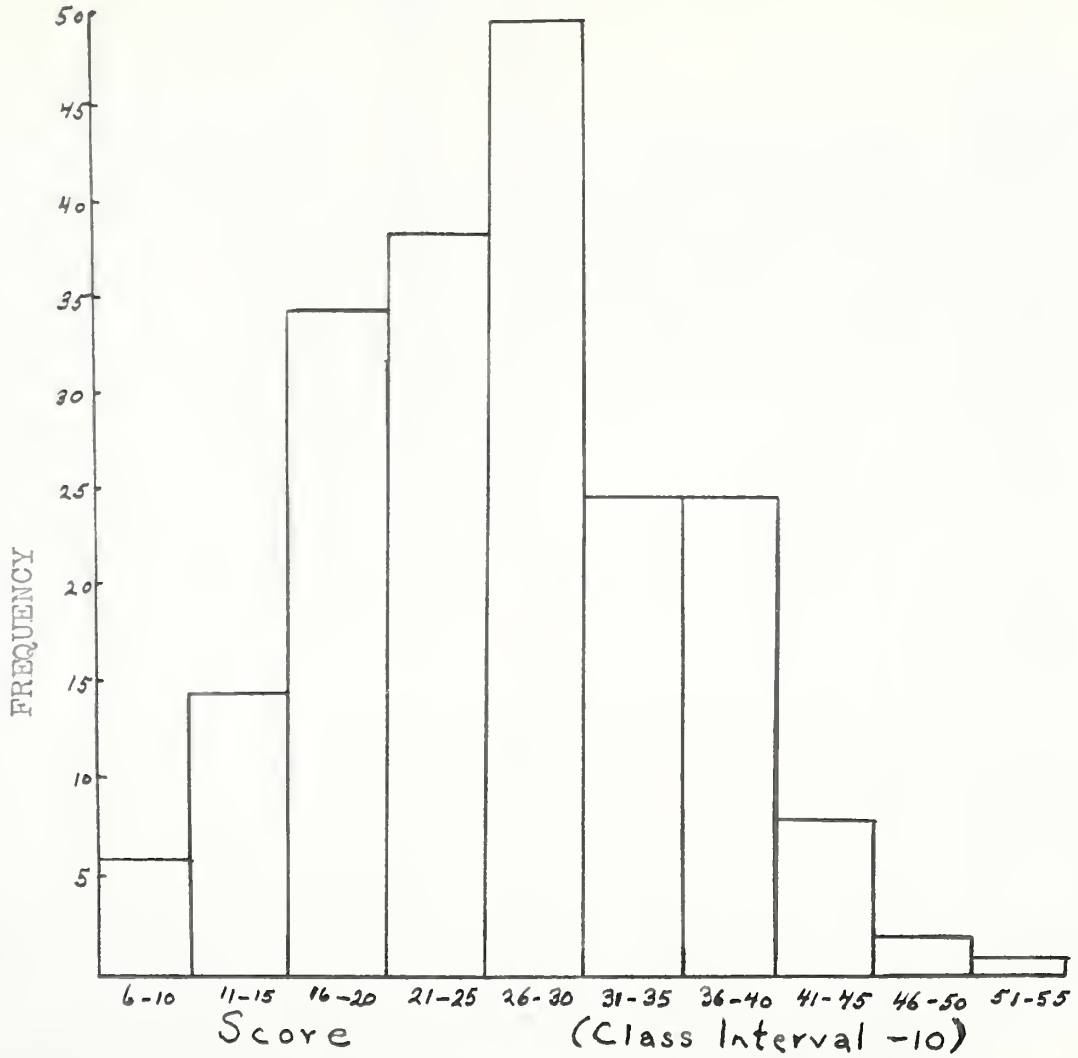


Fig. 13. - Frequency Distribution of Total Scores

Class	Frequency
6 - 10	6
11 - 15	14
16-20	34
21 - 25	38
26 - 30	49
31 - 35	24
36 - 40	24
41-45	8
46 -50	2
51-55	1

Total - 200

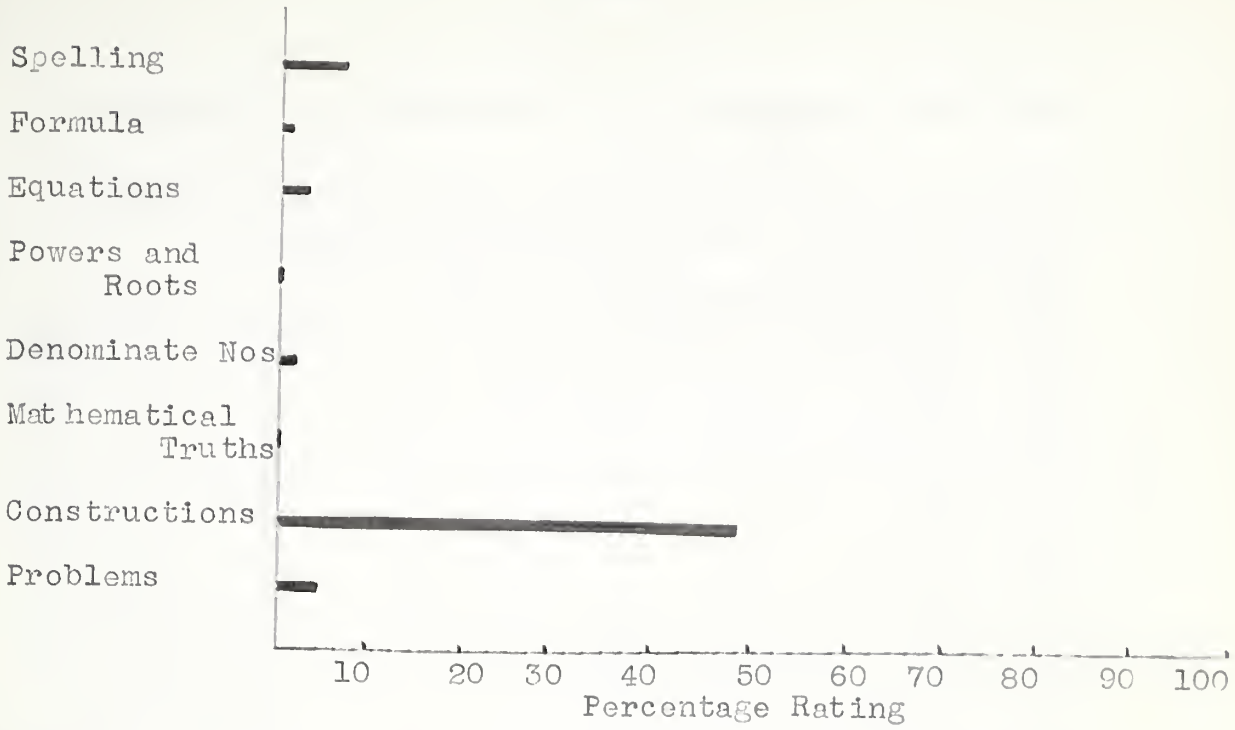


Fig.14.- Percentage of answers scored correct in each section of the Grade VIII test.

TABLE XXV

NORMS FOR EACH OF THE SECTIONS OF THE GRADE VIII TEST

	Possible Score on test	75% of Pupils Scored above	50 % of Pupils Scored above	25% of Pupils Scored above
Spelling	16	9	11	13
Formulae	4	0	0	1
Equations	11	1	3	4
Powers and Roots	9	1	2	3
Denominate Numbers	8	0	0	1
Mathematical Truths	4	0	0	1
Constructions	2	0	1	1
Problems	18	0	2	5
Total	72	19	26	31

TABLE XXVI

AGGREGATES AND AVERAGES IN EACH SECTION OF THE TEST

	Possible Score	Possible Aggregate	Actual Aggregate	Average Mark Score	Average Mark %
Spelling	16	3200	2328	11.64	72.7
Formulae	4	800	160	.80	20.0
Equations	11	2200	771	3.85	35.0
Powers and Roots	9	1800	554	2.77	30.0
DenominateNos.	8	1600	270	1.35	16.8
Mathematical Truths	4	800	210	1.05	26.2
Constructions	2	400	262	1.31	65.5
Problems	18	3600	707	3.58	19.6
Total	72	14400	5262	26.31	36.5

The above table indicates the possible scores and aggregates as well as the actual aggregates and arithmetic means established by 200 students for each of the sections of the Grade VIII test.

TABLE XXVII

COMPARISON OF AVERAGESIN GRADED AND UNGRADED SCHOOLS

Type	No.	Aggregate	Average Score	Average Mark-%
Ungraded	86	2312	26.86	37.3
Graded	114	2950	25.87	35.93
Total	200	5262	26.31	36.5

There is comparatively little difference in the average results of the pupils from the ungraded schools and those from the graded schools.

Eight sections constituted the test in Grade VIII. The total allocated score was 74 but the test was marked on the basis of 72, as Questions 3 and 6 of Mathematical Truths had insufficient data.

SPELLING

The first section was a spelling list of 16 words.

15 scored 16 marks (100%)

105 scored 12 or more.

182 scored 8 or more.

2 scored 4 or less.

The most common error was polygon; 72%

1. misspelled it as polygone, poligon, polligon and polagon.
2. Dimension - 56% misspelled this.
3. Octagon - 56% erred.
4. Hexagon - 44% erred.
5. Similar - 44% erred, usual error was similiar.
6. Algebra-
   Kilometer-
   Proportional -
   24% erred in each of these words.

FORMULA

The total score was 4. The mode was 0. The average was .8 or 20%.

1 pupils scored 4 marks.

10 pupils scored 3

29 pupils scored 2

70 pupils scored 1

90 pupils scored 0.

Description of Errors:

1. 64% erred in the calculations involved in Questions 1 and 2.

2. 26% stated 11.04 as the answer to Question 1, omitting to state the sq. in.

3. 8% erred in p;acing the decimal point in the product.

4. In Question 3:

(a) 32% did not divide by 38.

T equal LWH

(b) 8% multiplied by 38.

T equal 38Lwh

(c) 4% divided by T

$\frac{Lwh}{T}$

(d) Used x for multiplication

40% wrote lxwxh ÷ 38^3.

5. (a) Did not show addition (Question 5)

C equal nx C equal ny

30% erred in this; the ¢ sign was usually omitted.

(b) Divided

16% wrote C equal $\frac{N}{X}$

Very few students did Question 2 correctly.

EQUATIONS

6 equations to be solved and five equations to be formulated from given data comprised this section of the test for a total of 11 marks.

2 pupils scored 11.

16 pupils scored 8 or more.

47 pupils scored 6 or more.

94 pupils scored 3 or less.

The mode was 2.

Definite types of errors occurred:

1. 52% erred in placing the decimal point in Question 2.

2. 44% erred in the calculations involved.

3. 48% erred in transposing terms in the equations.

4b - 12 equal 24

4b equal 12

b equal 3.

4. 26% showed inability to formulate equations.

In Question 10:

(a) 8% wrote 1.2 - x equal 165

or 1.2 x equal 165.

(b) 18% wrote $\frac{x}{1.2}$ equal 165

In Question 11, perimeter was not calculated.

24% of pupils wrote;

3c plus 5c equal 80.

POWERS AND ROOTS

The total score was 9. 2 was the mode established. 2.77 was the average score.

0 pupils scored 9.

2 pupils scored 7 or more.

25 pupils scored 5 or more.

98 pupils scored 3 or less.

Description of Difficulties:

1. 56% did not understand factors from squares in Question 1. Gave Squares . (Factors of) 7^2 equal 49.

2. 12% erred in calculations.

22^2 equal 221

3. 4% did not understand the sq. root sign:
(puts a question mark)

$\sqrt{144}$ equal ?

4. 48% did not use the method requested in Question 6, but found the actual answer.

5. Difficulty in giving approximate square roots from table. (Question 7).

72% erred in $\sqrt{6290}$, usual answer was 79.3

56% erred in part b.

54% erred in part c.

The error apparently arose from not using the table, but calculating in the standard way--e.g. $\sqrt{6290}$ equal 79.3. Some students approximated and wrote as an answer 79.

DENOMINATE NUMBERS

8 questions were asked regarding the metric relationships. The mode established was 0. The full score was 8.

2 pupils scored 8 marks.

6 pupils scored 6 or more.

16 pupils scored 4 or more.

157 pupils scored 2 or less.

The average was 1.35 or 16.8%.

Types of Errors:

1. 4% did not know the cm.-mm. relationship.
2. 24% erred on the metre-cm. relationship.
3. 69% erred on the relationship of metres to yards.
4. 48% erred on the relationship of cm.-inches.
5. 40% erred in expressing the equivalent of 1 mile a min. in km. per hour (approx.).
6. 42% erred in the calculation of Question 8.

MATHEMATICAL TRUTHS

Six questions comprised this section; DE was not marked in the figure for Question 5, and the appeared advisable to exclude Questions 5 and 6 from the marking. Thus total score was 4.

The mode was 1.05.

Opupils scored 4.

4 pupils scored 3.

145 pupils scored 2.

108 pupils scored 1.

43 pupils scored 0.

Types of Errors:

1. 8% did not show knowledge of 180 as sum of the angles of a triangle.

   Many wrote 360.

2. 44% erred in showing relationship of the C to the F.
3. In Question 3.

   44% erred by writing hypotenuse equal hft.

   40% did not use square root sign:

x^2 plus y^2 equal hypotenuse.

4. In Question 4.

12% compared sides instead of area- 2:3

32% erred in computing areas;-

wrote 4:6; and in many cases, 8:12.

CONSTRUCTIONS.

Two exercises, asking for the construction of a regular hexagon, and an inscribed square in a circle, were given a mark each in this section of the test.

89 pupils scored 2. (full Mark).

84 pupils scored 1.

27 pupils scored 0.

The common errors:

1. Wrong calculation for angle at the centre

72 and thus constructed a pentagon.

2. Inaccuracy in drawing.

3. Failed to put diameters of circle at right angles to each other, thus not producing a square.

PROBLEMS

6 questions, valued at 3 each, comprised the last section of the test.

Principles involved:	No. of Question
Calculation of diameter from given area of circle	1
Calculation of hypotenuse in a right angled triangle	2
Calculating percentage of a part in a mixture	3, 4
Calculating distances from a scale drawing.	5, 6

The total scored was 18; the mode established by the group was 0. The average was 3.58 or 19.6%.

9 pupils scored 12 (highest mark)

25 pupils scored 9 or more.

73 pupils scored 6 or more.

124 pupils scored 3 or less.

Description of Errors:

1. 28% erred in calculation of Question 1.

2. 12% erred in procedure; forgot that r was squared and did not take the square root of the quotient of

346.5 divided by $\frac{22}{7}$.

Question 2. 52% failed to apply the principle of the right angled triangle correctly; a large number calculated poorly. Many added the squares of the 2 sides but did not take the square root of the sum.

Question 3. 58% calculated 6 as a part of 10 rather than of 16; usual answer was 60%.

Question 4. Various answers were given; the most common was 30 and 10. This indicated that reading had not been comprehensive. 50% erred in this question.

Question 5. 82% erred; most od these had no idea how to do the question.

Question 6. This also proved very difficult.

78% of the pupils failed to do it.

CHAPTER XI

GRADE IX

The test paper in Grade IX consisted of an A and a B section in Geometry and a paper in Algebra. The score for the Geometry was 100 and for the Algebra was 109, making the total score 209. 200 papers were marked for which the arithmetic mean was 98.4 or 47.08%.

The mode was 113

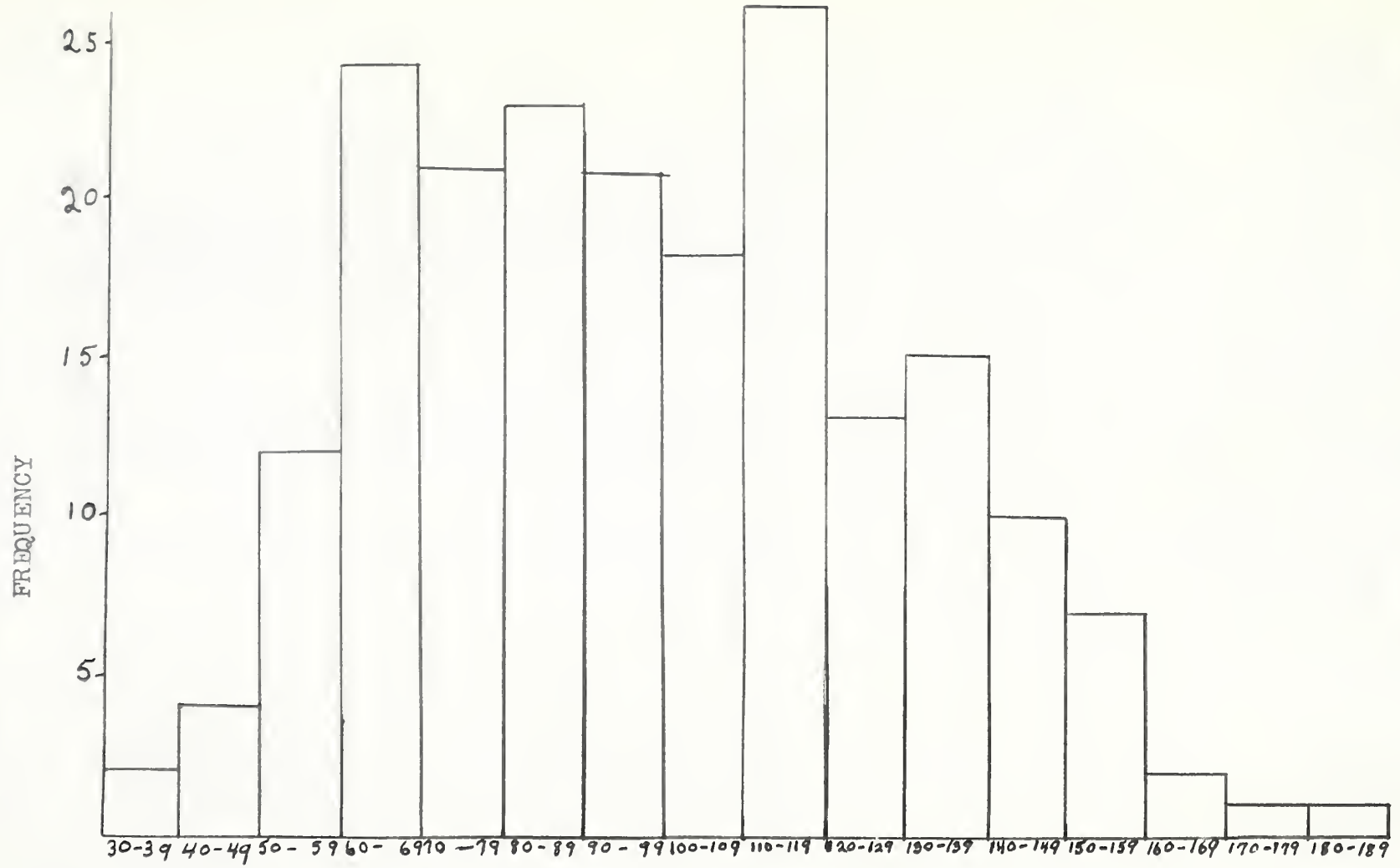
The median was 96.7

Q_1 was 73.7 ; Q_3 was 119.8

TABLE XXVIII

FREQUENCY DISTRIBUTION OF TOTAL SCORES

No.of Cases	Score	No.of Cases	Score	No.of Cases	Score	No.of Cases	Score	No.of Cases	Score
1	35	2	68	1	90	7	113	2	136
1	38	6	69	1	91	3	114	1	137
1	41	4	71	1	92	2	115	2	138
1	43	1	72	1	93	4	116	1	140
1	45	4	73	3	94	1	117	3	141
1	48	4	74	3	95	1	118	1	142
2	51	2	75	2	96	3	119	1	144
1	53	2	76	2	97	1	120	1	146
1	54	2	77	3	98	3	121	2	147
2	56	1	78	4	99	4	122	1	149
3	57	1	79	1	100	2	123	1	150
2	58	4	80	4	101	1	126	3	151
1	59	2	81	3	102	1	127	1	156
1	60	4	82	3	103	1	128	2	157
4	62	3	83	3	105	3	130	1	161
2	63	2	84	1	106	2	131	1	163
3	64	1	85	1	107	1	132	1	172
1	65	4	86	2	108	1	133	1	183
2	66	2	88	2	111	2	134		
3	67	1	89	3	112	1	135		



CLASS	FREQUENCY
30-39	2
40-49	4
50-59	12
60-69	24
70-79	21
80-89	23
90-99	21
100-109	18
110-119	26
120-129	13
130-139	15
140-149	10
150-159	7
160-169	2
170-179	1
180-189	1
TOTAL	200

Fig. 15. – Frequency distribution of total scores.

TABLE XXIX

CLASSIFICATION OF SCORES BY AGE GROUPS

Age Group (years)		No.	Average Age (Months)	Average Score
13½ - 14	Boys	1	163	83.0
	Girls	3	166	95.5
14 - 14½	Boys	7	171.1	115.0
	Girls	6	159.5	88.2
14½ - 15	Boys	7	176.4	96.8
	Girls	8	171.3	112.7
15 - 15½	Boys	21	182.3	98.6
	Girls	24	183.9	93.3
15½ - 16	Boys	15	188.6	104.0
	Girls	22	189.3	102.2
16 - 16½	Boys	19	195.0	105.1
	Girls	17	194.2	94.1
16½ - 17	Boys	10	200.4	87.6
	Girls	11	200.2	92.8
17 - 17½	Boys	3	205.6	79.5
	Girls	6	207.3	99.3
17½ - 18	Boys	4	213.4	85.0
	Girls	3	213.0	65.0
18 - 18½	Boys	3	219.6	60.2
	Girls	-	-	-

As in the lower grades, the highest age groups made the lowest scores represented by averages for the groups. Even the youngest show a better average than the oldest age class. The girls of four classes surpassed the boys in average scores, the boys leading in the other five age groups where both are shown.

TABLE XXX

CLASSIFICATION BY SEX

	No.	Aggregate	Average age (yrs.)	Average Score
Boys	90	8823.75	15.8	98.0
Girls	110	10857.25	14.04	98.7
Total	200	19681.	14.8	98.4

There is no appreciable difference in the average scores made by each sex; but the average age for the girls is 1.76 years less than for the boys and their score is .7 of a point higher in the average.

TABLE XXXI

COMPARISON OF GRADED AND UNGRADED SCHOOL RESULTS

Type	No.	Aggregate Score	Average Mark (Score)	Average Mark (%)
Ungraded	84	9275.75	110.5	52.41
Graded	116	10405.25	89.7	42.9

The Grade IX students from the ungraded schools made a considerably higher average on the Survey tests as indicated in the table above.

TABLE XXXII

AGGREGATES AND AVERAGES IN EACH SECTION OF THE GRADE IX TEST

	Possible Score	Possible Aggregate	Actual Aggregate	Average Mark Score	Average Mark %
Spelling	6	1200	848	4.24	70.6
Congruence	13	2600	896	4.48	34.4
Inferences	16	3200	926	4.88	30.5
Language	20	4000	1301	6.55	32.7
Symmetry	9	1800	954	4.77	53.0
Locus	8	1600	400	2.00	25.0
Right-angled Triangle	9	1800	719	3.59	39.8
Constructions	19	3800	1312	6.56	34.5
Geometry Total	100	20000	7407	37.03	37.0
Spelling	6	1200	954	4.77	79.5
Addition	8	1600	1478	7.39	92.3
Subtraction	10	2000	1704	8.52	85.2
Multiplication	4	800	758	3.79	94.7
Division	7	1400	1097	5.48	78.2
Computations	39	7800	3693	18.46	47.3
Equations	15	3000	1661	8.30	55.3
Problems	20	4000	919	4.59	22.9
Algebra Total	109	21800.	11274	56.37	51.7
Total	209	41800.	19681	98.4	47.08

The above table indicates the possible scores and aggregates as well as the actual aggregates and average scores established in each section of the Grade IX test.

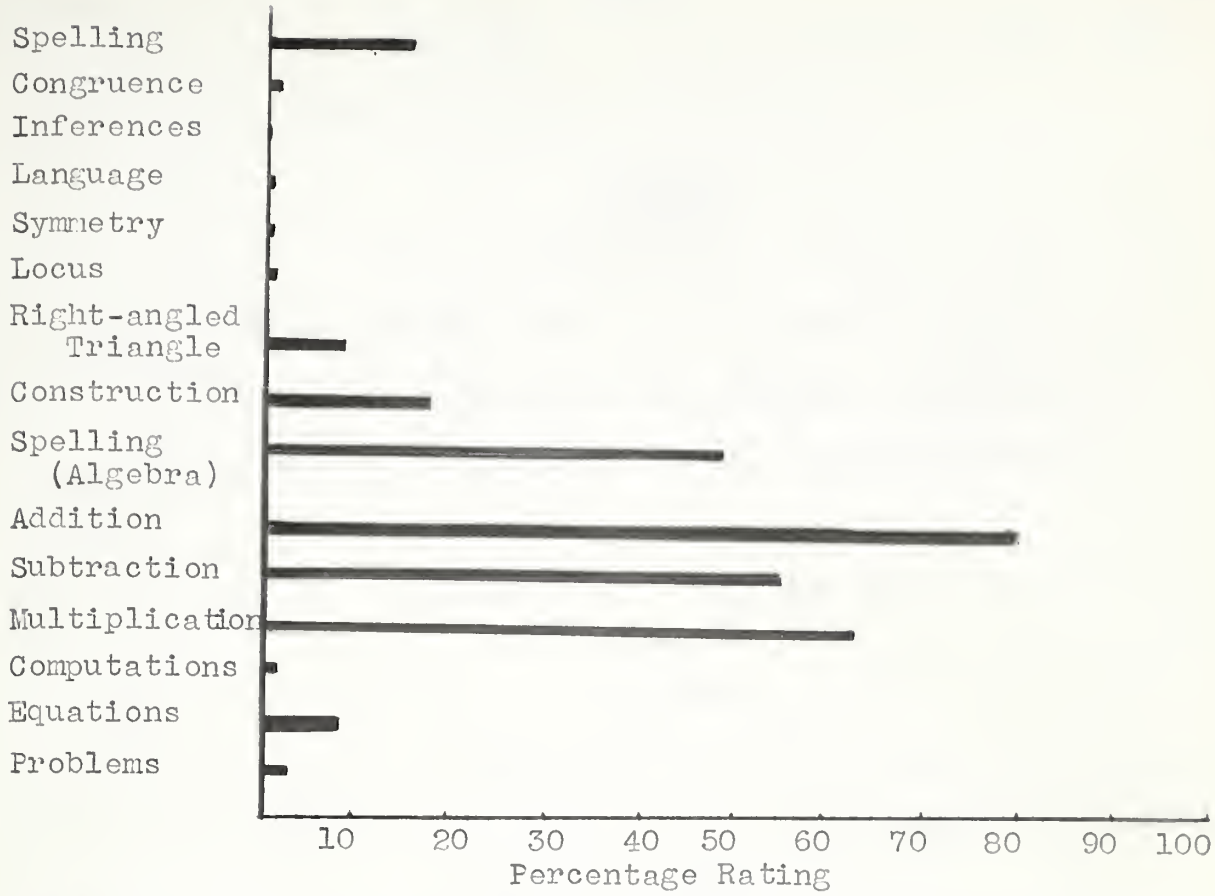


Fig. 16.- Percentage of answers scored correct in each section of the Grade IX test.

TABLE XXXIII

NORMS FOR EACH SECTION OF THE GRADE IX TEST

	Possible Score on test	75% of Pupils Scored above	50% of Pupils Scored above	25% of Pupils Scored above
Spelling	6	3	4	4
Congruence	13	2	3	5
Inference	16	2	3	5
Language	20	3	5	8
Symmetry	9	3	4	5
Locus	8	0	1	2
Right-angled Triangle	9	2	2	5
Constructions	19	0	4	11
GeometryTotal	100	24	35	46
Spelling	6	3	4	5
Addition	8	7	7	7
Subtraction	10	7	9	9
Multiplication	4	3	3	3
Division	7	4	4	6
Computations	39	10	17	25
Equations	15	5	8	11
Problems	20	0	4	5
Algebra Total	109	47	61	73
Total	209	73	93	118

The Grade IX paper consisted of two main sections, Geometry and Algebra.

GEOMETRY

This section of the test was in Part A and Part B with a total score of 100. Spelling, congruence, Inferences and Language comprised the Part A. The median for the Geometry test was 35.9

Q_1 was 28.1; Q_3 was 45.1

SPELLING

6 marks were allotted to the 6 words of this section.

30 pupils scored 6.

157 pupils scored 5 or more.

180 pupils scored 3 or more.

20 pupils scored 2 or less.

The average was 4.24 or 70.6%.

Errors:

1. 88% erred in spelling symmetry, as symetry or simmetry or symitry.
2. 44% misspelled parallelogram.
3. 40% misspelled trapezium.
4. 36% misspelled similarity, as similiarity or as similaraty.
5. 22% misspelled quadrilateral.
6. 8% misspelled rhombus.

CONGRUENCE

Three questions comprised this section. 13 marks, as distributed according to the key, were assigned.

2 pupils scored 13.

10 pupils scored 10 or more.

35 pupils scored 7 or more.

111 pupils scored 4 or less.

The average was 4.48 or 34.4%.

Description of Errors:

1. 41% of pupils considered the perpendiculars were equal and thus gave three sides of one triangle respectively equal to three sides of the other.

   8% had showed no idea in the attempt made.

2. 32% gave as an answer that the two sides and diagonal were respectively equal.

   DA, AB and DB respectively equal DC, BC and DB.

   The diagonal having been given required demonstration of the knowledge that a diagonal bisects the angles through which it passes.

3. 8% did arrange the sides or angles in a respective order.

4. 8% failed to make the proper construction for Question 3; 40% failed to write a correct proof.

INFERENCES

4 marks were allocated to the 16 blanks to be filled in the first Question on diagonals in this section. The remaining 3 questions were allotted 4 marks each, making the total score for Inferences 16 marks. The mode was 3.

0 pupils scored 16.

6 pupils scored 12 or more.

32 pupils scored 8 or more.

124 pupils scored 4 or less.

Types of Errors:

1. 12% did not express knowledge regarding bisection of angles by diagonals.

   4%erred in the section regarding diagonals bisecting each other.

   8% erred in the last part regarding equality of diagonals.

2. 48% did not specify units in giving the answer to Question 2.

   56% did not recognize the rates of 18:12 or $1\frac{1}{2}$ to 1 and thus gave a variety of incorrect figures.

3. 24% erred in Question 3 by subtracting 6" from 15", giving an answer of 9".

   12% subtracted 15" from 21 in., giving an answer of 6 in.

   8% subtracted 6 in. from 21.21 in., giving an answer of 15.21 in.

4. In Question 4;

   16% erred in the first part by saying yes.

   40% erred in mixing ideas of perimeter and area.

   24% drew three separate parallelograms without showing any proper relationship.

   24% in comparing area, multiplied the base by the end instead of by the altitude.

LANGUAGE

Ten questions comprised this section. A total of 20 marks was allotted. Five questions required constructions as interpretations of written data.

1 pupil scored 20 (full mark)

11 pupils scored 15 or more.

40 pupils scored 10 or more.

97 pupils scored 5 or less.

The average score was 6.55 or 32.7%

Classification of Errors:

1. In questions 2 and 3, 64% did not understand the question; many in question 1 simply reflected in the blank the words of the question.
2. In Question 3, 44% drew the figures similar.
3. In Question 4. results were better; 12% erred by making both angles and sides similar.
4. 4% erred in interpreting Question 5 correctly.
5. 8% erred in Question 6 and 8.
6. 12% erred in Questions 7, 9 and 10.
   Question 10 might be worded "median to the base" for the only answer of an "isosceles triangle". As the question reads an equilateral triangle might be a correct answer as well.

TEST B

This section of the geometry test consisted of 4 sections--Symetry, Locus, Right angled Triangle, and Constructions. The total score was 45.

SYMMETRY.

Nine questions rated at 1 mark each comprised this first section of the test. Five questions were on axes of symmetry and four on point symmetry of various plane figures.

1 pupil scored 9 (full mark).

37 pupils scored 7 or more.

114 pupils scored 5 or more.

46 pupils scored 3 or less.

The average was 4.77 or 53%

The mode was 5.

Errors:

1. 36% erred in saying that a circle has 1 axis of symmetry.
   12% stated it had 4 axis of symmetry.
2. 12% erred in stating that an isosceles triangle has 2 axis of symmetry; the idea arose, no doubt from the idea of 2 equal sides for the triangle . Idea of the median from the vertex is not clear.
3. 20% erred in stating that a rectangle has 4 axis of symmetry. Most of these had answered 4 for the previous question on the square.

The common error in all these expressions is that the child was not clear what an axis of symmetry is. He must develop the idea that the two halves of the figure folded along the axis will coincide and that certain figures can only be folded in certain ways.

4. 31% erred in point symmetry in stating that a rectangle has not point symmetry. (Question 9).
   16% erred by replying in the affirmative for Question 8.

20% erred in Question 7 by stating a square does not have point symmetry.

(Point symmetry is not dealt with very fully in the text)

LOCUS

Six questions with an allocation of 8 marks comprised this section. The mode was 1. The average was 2. or 25%.

1 pupil scored 8 marks.

5 pupils scored 6 marks or more.

32 pupils scored 4 or more.

133 pupils scored 2 or less.

Types of errors:

There was a general weakness in showing comprehension of the meaning of locus. Most students answered the first question correctly.

Question 2. 24% erred; usually the answer was a straight line (20%). 4% wrote a rectangle; perhaps this was closer if it had been conceived of as standing on its edge.

Question 3. This question had two parts.

(a) 20% erred in answering, a straight line.

4% erred in answering a circle.

(b) 12% said a semicircle

12% wrote a line.

Question 4. 24% answered "a line".

12% answered , are of a circle.

Question 5. 28% wrote a circle.

8% wrote "plane".

Question 6. 32% wrote a line

16% wrote , oblong figure.

RIGHT ANGLED TRIANGLE

Three questions valued at 9 marks comprised this section.

8 pupils scored 9 (100%).

8 pupils scored 7 or more.

75 pupils scored 5 or more.

125 pupils scored 3 or less.

The Average was 3.59 or 39.8%.

Description of Difficulties:

1. 12% erred in calculation.
2. 20% failed to recognize the principle of the right angled triangle in the second question.
3. 36% did not use the principle of the right angled triangle in the third question.

   Most of these calculated the square root of 2 and drew a line that length.
4. 7% stated that $\sqrt{2}$ equals 4 and drew a line 4 inches long.

CONSTRUCTION

Construction 7 and 8 and Theorem 21 of the text comprised the test on Construction that concluded the Geometry Test. 3, 6 and 10 marks respectively were given for the 3 questions. In Questions 3, 3 marks were allotted for constructions an 7 for proof.

17 pupils scored 19 (100%)

33 pupils scored 15 or more.

61 pupils scored 10 or more.

103 pupils scored 5 or less.

The average was 6.56 or 34.5%.

Errors:

1. 24% used the wrong method in dividing the line in four parts.

   The usual error was to bisect the line and then bisect each of the halves.
2. 16% erred in the construction or in the designation of the right triangle which equaled the area of the given quadrilateral.
3. 16% erred in making the construction in Question 3.

   34% erred in writing the proof of the theorem.

ALGEBRA

The test on Algebra consisted of eight divisions with a table score of 109. The median was 61.4.

Q_1 was 49;1; Q_3 was 76.2

The results in Algebra were higher than for Geometry. The average in Algebra being 51.7% while that for Geometry was 37%.

SPELLING

Six words were given with an allocation of 6 marks.

92 pupils scored 6 marks.

161 pupils scored 4 marks or more.

172 pupils scored 3 marks or more.

27 pupils scored 2 or less.

The mode was 6.

Errors:

1. The heaviest error was on the word, binomial. 44% erred in spelling it as bionomial or as binomiol.
2. 40% erred in spelling trinomial; the type of error was the same as number 1.
3. 28% erred in the spelling of polynomial; the usual error was polonomial.
4. 28% also erred in writing exponent as exponant.
5. 20% erred in spelling monomial.

It is suggested that the terms,- monomial, binomial, trinomial and polynomial need to be used more frequently in the classroom usage, so that students be more familiar with the technical terminology of the subject.

ADDITION

Eight questions valued at 8 marks comprised the section. The test emphasized the use of plus or minus signs in addition.

154 pupils scored 8 (full mark).

189 pupils scored 6 or more.

192 pupils scored 4 or more.

12 pupils scored 2 or less.

This section was comparatively well done and rated one of the highest sections of the whole test. The average was 92.3%.

Errors:

1. 16% erred by assuming 2 minus signs gave a plus sign in the sum.

$$\begin{array}{r} -7 \\ -2 \\ \hline 9 \end{array}$$

2. 8% gave no regard for the signs.

$$\begin{array}{r} 10 \\ -\ 7 \\ \hline 17 \end{array} \qquad \begin{array}{r} -4 \\ 8 \\ \hline 12 \end{array}$$

3. 4% subtracted; that is changed the sign of the bottom number before combining.

SUBTRACTION

Ten questions involving the knowledge of plus and minus signs comprised this section.

107 pupils scored 10 (100%).

163 pupils scored 8 or more.

180 pupils scored 5 or more.

14 pupils scored 3 or less.

This section also was fairly high in results. The average was 85.2%.

1. The chief error lay in not changing the sign of the subtrahend before combining.

$$\begin{array}{r} -15 \\ \ \ 6 \\ \hline -\ 9 \end{array}$$

32% erred in this respect.

2. A few more did not recognize the effect of the minus sign before a bracketed expression.

8% wrote

(plus 7) - (-6) equal 1.

It is possible that these students took out the 6 as a positive quantity and then subtracted it from 7.

MULTIPLICATION

4 questions were placed in this section.

172 pupils scored 4 marks (full mark).

18 pupils scored 3.

7 pupils scored 2.

2 pupils scored 1.

1 pupil scored 0.

The average was 94.7%.

Errors:

1. Does not recognize unlike signs give minus.

   (plus 6) times (minus 4) equal plus 24.

   8% erred in this.

2. 7% erred in writng 2 minuses give a product with a minus sign.

   (minus 3) times (minus 7) equal minus 21.

3. 4% showed weakness in multiplication tables.

DIVISION

7 examples valued at 1 mark each comprised this section of the Signed Numbers.

The average was 5.48 or 78.2%.

The mode was 7.

61 pupils scored 7

164 pupils scored 5 or more.

177 pupils scored 4 or more.

9 pupils scored 2 or less.

The most common error occurred in Question 27; the answer usually given was 10. 64% erred in this particular type. In Question 28 many also erred, but there was less tendency there to divide by the wrong number.

COMPUTATIONS

Twenty questions comprised this section of the test. Simplification of algebraic expressions, addition, multiplication and division of terms were all featured in the test. The total mark was 39.

1 pupil scored 39 (full mark).

31 pupils scored 30 or more.

91 pupils scored 20 or more.

39 pupils scored 10 or less.

The average was 18.46 or 47.3%.

Types of Errors:

1. 72% erred in calculation, usually in the signs.
2. 56% did not change the sign of a number within a bracket when a minus sign preceded the brackets.

   Question No. 3 and No. 8 revealed this weakness most commonly.
3. 64% erred in dividing the indices in division.

   Question 16

   $a^{10} \div a^2$ equal a^5 was the usual answer.
4. 48% erred in treatment of indices in multiplication.

   $35h^2$ times 5h equal $175h^2$
5. 28% erred in Question 8 in making substitutions in the expression.
6. 24% erred in adding instead of multiplying (Question 9)

   (minus 3a) plus (minus 4a) (plus 2b) equal 7a plus 2b.
7. 4% did not change the sign in subtraction.
8. 12% did subtract instead of add in Question 12.
9. 12% multiplied instead of adding in Question 7.

EQUATIONS

Five equations were given with an allotted mark of 3 marks each.

16 pupils scored 15 marks (100%).

63 pupils scored 12 or more.

117 pupils scored 8 or more.

41 pupils scored 4 or less.

The average score was 8.3 or 55.3%.

The mode was 12.

Description of Errors:

1. 52% erred in transferring terms.
2. 70% erred in Question 5 -- the usual answer was $\frac{r}{pt}$ plus p - a.
3. 16% showed weakness in combinations.
4. The greatest difficulty in Question 3 appeared to be in the calculation of the fractions; 52% erred in this question alone.

Question 2 had the least errors of the group.

PROBLEMS

4 problems in whcih the student had to write his own equations constituted the last section of the test. The total value was 20 marks.

5 pupils scored 20 marks (full mark)

13 pupils scored 15 marks or more.

42 pupils scored 10 marks or more.

151 pupils scored 5 marks or less.

The average mark was 4.59 or 22.9%.

Errors:

1. 56% erred in forming equations.
2. 12% erred in calculation.
3. 10% failed to recognize the relationships in a right angled triangle in Question 4.

The heaviest failure was in Problem 4, 88% failed to formulate the proper equation or miscalculating.

80% failed to obtain the correct answer in Question 2.

There was apparently the same difficulty as

occurred in all the other grades; the students do not seem to read carefully enough for a correct interpretation that expresses itself in a well reasoned result.

TABLE XXXIV

COMPARISON OF SURVEY TEST RESULTS WITH DEPARTMENTAL FINAL RESULTS

	Survey Test May 31st	Dept. Final June
Number of students	200	195
Total Mark on Paper	209	184
Average Mark (%)	47.08	58.8
Median (%)	47.13	59.9
First Quartile (%)	35.2	47.6
Third Quartile (%)	57.3	71.3
Geometry Section -		
Total Marks on paper	100	91.
Median (%)	35.9	51.7
First Quartile (%)	28.1	40.1
Third Quartile (%)	45.1	64.1
Algebra Section -		
Total Marks on paper	109	93.
Median (%)	56.3	67.6
First Quartile (%)	45.4	53.1
Third Quartile (%)	69.7	80.0

The figures given in the second column are for the results of 195 of the students listed in the first column. The writer sent in the names of the writers of the Survey Tests and received the raw scores made by all those students who wrote the final examination in the next month. Five students of the lot did not write and so the figures in the second column are computed on the basis of 195 cases.

Though the median and other Quartiles are higher in the June examination, it is most significant that there also the students had greater difficulty with the geometry section of the examination as they had had in May with the Survey Test. Continued review and the attitude attendant with a final examination may have been factors in increasing the results shown above.

CHAPTER XII

SUMMARY, SUGGESTIONS, AND CONCLUSIONS

The first section of this chapter gives the quartiles of the total scores in the tests of the eight grades. Following that is a tabular summary of the arithmetic means established in each section of the tests of all the grades.

TABLE XXXV

QUARTILES OF THE TOTAL SCORES OF ALL GRADES

Grade	Possible Score on Test	First Quartile	Second Quartile (Median)	Third Quartile
2	125	72.1	88.0	101.6
3	131	54.1	69.2	89.2
4	118	45.0	59.3	72.7
5	153	74.8	90.5	103.1
6	131	53.8	69.5	83.6
7	106	39.7	49.1	61.2
8	72	19.9	26.3	32.4
9	Entire test 209	73.7	96.7	119.8
	Geometry test 100	28.1	35.9	45.1
	Algebra test 109	49.1	61.4	76.2

TABLE XXXVI

ARITHMETIC MEANS IN EACH SECTION OF THE TESTS OF ALL GRADES

Grade II: 68.6%.

Test A Part 1.	Addition (24 questions) ----------	84.9%
2.	Subtraction (26 questions) -------	68.1%
3.	Writing Numbers (4 questions) ----	81.7%
4.	Number Senses (4 questions) ------	57.2%
5.	Notation (5 questions) ----------	86.2%
6.	Assorted Questions (9 questions)--	55.2%
Test B Part 1.	Language (12 questions) ----------	69.0%
2.	Telling Time (3 questions) ------	48.3%
3.	Denominate Numbers (4 questions)--	58.0%
4.	Problems (10 questions) ----------	62.4%

Grade III: 53.1%

Test A Part 1.	Spelling (15 words)	----------	47.1%
2.	Language (12 questions)	----------	62.5%
3.	Activities(3 questions)	----------	55.0%
4.	Denominate Numbers (15 questions)	--	54.2%
5.	Fractions (10 questions)	----------	45.6%
6.	Addition (4 questions)	----------	74.0%
7.	Subtraction (4 questions)	----------	63.0%
8.	Multiplication (6 questions)	------	72.8%
9.	Division (10 questions)	----------	48.5%
Test B Part 1.	Generalizations (4 questions)	-----	18.3%
2.	Problems (12 questions)	----------	57.3%

Grade IV: 49.7%

Test A Part 1.	Spelling (18 words)	----------	60.2%
2.	Language (6 questions)	----------	28.0%
3.	Denominate Numbers (19 questions)	--	54.4%
4.	Fractions (12 questions)	----------	50.6%
Test B Part 1.	Addition (4 questions)	----------	80.0%
2.	Subtraction (4 questions)	----------	75.0%
3.	Multiplication (14 questions)	------	70.2%
4.	Division (10 questions)	----------	36.7%
5.	Problems (12 questions)	----------	28.9%

Grade V: 57.9%

Test A Part 1.	Spelling (16 words)	----------	69.6%
2.	Number System (7 questions)	------	44.0%
3.	Language (4 questions)	----------	34.7%
4.	Denominate Numbers (10 questions)	--	59.5%
5.	Fractions (19 questions)	----------	63.6%
Test B Part 1.	Addition (15 questions)	----------	73.4%
2.	Subtraction (8 questions)	----------	81.1%
3.	Multiplication (6 questions)	------	60.8%
4.	Division (14 questions)	----------	52.5%
Test C Part 1.	Problems (14 questions)	----------	40.5%

Grade VI: 51.9%

Test A Part 1.	Spelling (12 words)	----------	74.0%
2.	Number System (7 questions)	-------	62.7%
3.	Language (5 questions)	----------	31.8%
4.	Denominate Numbers (6 questions)	--	41.0%
5.	Common Fractions (10 questions)	---	66.8%
6.	Decimals and Decimal Fractions (13)		61.6%
Test B Part 1.	Addition (8 questions)	----------	77.6%
2.	Subtraction (10 questions)	----------	61.7%
3.	Multiplication (9 questions)	------	64.2%
4.	Division (8 questions)	----------	43.0%
Test C Part 1.	Graphs (2 questions)	----------	53.2%
2.	Problems (10 questions)	----------	28.5%

Grade VII: 47.5%

Test A Part 1.	Spelling (33 words)	----------	73.5%
2.	Graphs (2 questions)	----------	47.5%
3.	Interest and Insurance(3 questions)	-	39.3%
4.	Language (15 questions)	----------	21.6%
Test B Part 1.	Formulae and Equations(8questions)	-	45.8%
2.	Geometric Truths (5 questions)	----	29.7%
3.	Problems (5 questions)	----------	13.6%
4.	Constructions (5 questions)	------	42.1%

Grade VIII: 36.5%.

Test A Part 1.	Spelling (16 words)	----------	72.7%
2.	Formulae (4 questions)	----------	20.0%
3.	Equations (11 questions)	----------	35.0%
4.	Powers and Roots (7 questions)	----	30.7%
5.	Denominate Numbers (8 questions)	--	16.8%
6.	Mathematical Truths(4 questions)	---	26.2%
7.	Constructions (2 questions)	-------	65.5%
8.	Problems (5 questions)	----------	19.6%

Grade IX: 47.08%

Test A Part Geometry	1.	Spelling (6 words)	70.6%
	2.	Congruence (3 questions)	34.4%
	3.	Inferences (4 questions)	30.5%
	4.	Language (10 questions)	32.7%
Test B Part	1.	Symmetry (9 questions)	53.0%
	2.	Loci (6 questions)	25.0%
	3.	Right-angled Triangle (3 questions)	39.8%
	4.	Constructions (3 questions)	34.5%
Algebra			
Test A Part	1.	Spelling (6 words)	79.5%
	2.	Addition(8 questions)	92.3%
	3.	Subtraction (10 questions)	85.2%
	4.	Multiplication (4 questions)	94.7%
	5.	Division (7 questions)	78.2%
	6.	Computations (20 questions)	47.3%
	7.	Equations (5 questions)	55.3%
	8.	Problems (4 questions)	22.9%

SUGGESTIONS FOR CHANGES IN TESTS.

Grade II: Question 7 and 8 of A-2;- children missed reading the heading, "By how many is"; They read:

200 is greater than 180 and wrote yes or 380.

The error in Number 8 was similar, the answer commonly being yes.

The question should read:

Number 7: By how many is 200 greater than 180?

Number 8: By how many is 60 less than 100?___

Section A-2 should be in four sub-sections:

1. The first 4 questions are on writing numbers for which the key allots 4 marks.
2. The next four questions on Number Senses should be set appart as number 1, 2, 3 and 4 and the similar separation made on the key.
3. The next five questions belong to a sub-section of Notation and the key should similarly show this sub-division with an allocation of 5 marks.
4. The questions designated as 14 - 22 inclusive areaan assorted Group that might be numbered 1 - 9 inclusive and indicated similarly on the key with the total allocation of 17 marks allowed.

Such division would facilitate marking and give more definite classification of the difficulties involved for the benefit of teachers.

The course of study for Grade II requires that children should be able to count by 2's to 50, (page 264), starting at any limits; the question, number___, asking for the even numbers between 30 and 50 was no doubt based on this; but a child may count by 2's and not associate

that with the idea of even numbers past 20 according to Section 13, page 264 of the Course of Studies. A change in the wording of this question would seem warranted. I would also suggest that in the assorted question this same question gets credit for 9 marks out of the total of 17 whereas there were at least five items of factual knowledge asked for altogether.

Section B-2 should have further sub-divisions. Questions 4 - 7 inclusive pertain to Denominate Numbers and for easier classification should be a separate section, numbered 1-4 inclusive both on the text and on the key.

In the subtraction section I would suggest an example with the zero in the subtrahend as an item of knowledge to be checked in its relation to the difficulties arising from a zero in the minuend.

Grade III: This is a very comprehensive survey test for Grade III. Many teachers may feel that only one third of the marks is not enough for the fundamental processes as they consider this part of the course, the chief work of Grade III. But this test will indicate just what the scope of the course is and it gives proper regard for all phases of it.

It is a moot point whether Grade III should be expected to do the last question in Division involving the proper placing of the decimal point.

It is also suggested that the last question on the course is a three step operation and appears beyond the requirements of the Course.

Grade IV: Spelling should be closely associated with pronounciation. The errors seemed to indicate

that a student was trying to spell the word as it is commonly pronounced.

The last question should have an allocation of 4 marks -- 2 for the form and 2 for the answer; thus 26 would be the score on the last section giving a total of 118 on the whole paper.

Area is dealt with in Grade V; the question involving sq. ft. appeared to advanced for Grade IV. Page 270 of the Course of Study relegates areas of squares and rectangles in sq. ft. to the Grade V course. Grade IV study perimeter and since the common error arose from an idea of perimeter, it is likely that many of the students had not taken work in area yet.

In Question Number 9 of the Problem section I would suggest inserting the word whole before "foot". The sentence would thus read: "Rewrite the following measures to the nearest whole foot".

A word may be said about the placing of remainders after the quotient with a minus sign separating them. A very large number of studants did this in several grades and many teachers acquiesce in this procedure. But it may be mentioned that the text book is very definite it its instructions regarding the correct representation of the remainder.

Grade V: A large part of the test required analysis. There was good attention given to the language of arithmetic in this test paper. There must be language and spelling as familiarity with the terminology of the subject is part of the content of the course. This was a good survey test in that nearly all principles demanded by

the course of study were represented. I would suggest that multiplication of numbers each containing zeroes, such as 100 by 100, might be included in the examples. Grade IV papers indicated considerable difficulty with zeroes in multiplication. Questions 1 and 3 of the language section requested a choice between larger and smaller. The child's usual experience in Grade V division is that the quotient is larger and when the question suggested, a choice between larger and smaller, the experience would prompt an answer, "larger".

Grade VI: This test was very comprehensive and should form an excellent means for teachers to study the weaknesses of their classes.

Grade VII: In the Grade Vii tests, an error appeared in the second "amount" under Question 3 of Insurance section; the amount $12.90 should be $1290.00. It might be an advantage in the B part of the paper under Problems to put Questions 6 - 10 inclusive under a separate section designated as Constructions.

Grade VIII: In Question 5 of Mathematical Truths, the length of DE should be stated. I would suggest that a greater difference than one sixteenth of an inch be made between the sides AC and BC and between the sides EF and DF respectively. Of course if the student measures AB exactly as 1 3/16 inches and BC as 1 2/16 inches, then he should be able to choose the corresponding sides of 1 12/16 in. and 1 11/16 in. respectively if he measures carefully in the second triangle.

Grade IX:

Congruence

Question 2; The key suggests the corresponding sides as an answer. But it would appear that the diagonal and the sets of corresponding angles resulting from the bisection by the diagonal might be given as a correct answer.

Language:

Question 1: The answer should read;

AC^2 plus DB^2 equal $4AB^2$

Question 10: As the question reads, equilateral triangle would also be a correct answer. Question should read; In what case is the median <u>to the base</u> of a triangle. Also a right bisector.

Part B - Geometry:

Symmetry; There is little information in the text book about point symmetry. The only reference to figures other than a circle is on page 320 of the text in Question 4 of the Quiz. which asks, "Does any type of quadrilateral have symmetry about a point?"

Algebra:

The total score for this test is 109 rather than 110.

GENERAL CONCLUSIONS

In a written diagnostic test it is difficult to find all the errors such as counting or others that verbal statements would reveal.

Insistance on pupils showing their work on the space provided would facilitate further diagnosis.

Although there is evidence that mechanical drill on the four fundamental operations of arithmetic receives the greatest emphasis, yet there is an abundance of errors throughout the grades in the number combinations and use of the multiplication tables. The mechanical drill has no doubt emphasized a symbolism quite separate from any significant experience with the concepts involved. Any symbolism should have its basis on an association with concrete materials. When a child, having learned counting, combines one object with three objects he finds by experience that he has four objects, and he may associate the symbolism of one plus 3 with that experience. If learning is based on forming certain connections, then a proper connection for a correct response should be established at first. Combinations may just as well be learned correctly the first time, as it should be as easy to associate the correct answer with a combination as the wrong number. Notation must be clearly understood and then combinations established in association with meaningful activity. Mere repetition of a corrected answer to a combination is not a satisfactory substitute for the required experience. Realization of the uniqueness of our number system demands that careful direction be given the child in each step in the process of learning the number symbolism. Number combinations are important in all the fundamental operations and are equally necessary in other parts of the subject as in denominate relationships. Each grade includes more new concepts of the number symbolism that must be established on the factual knowledge of previous grades.

It is apparent in the tests that the mechanical drill alone on fundamental operations has not justified itself as an only method. Errors in number combinations occurred throughout the grades, although there is usually a lessening of the percentage of errors in the higher grades. In addition weakness in combinations increased from 28% in Grade II to 40% and 49% in Grades III and IV respectively. There was little lessening of this rate of error until Grade VI, where the errors fell to 16%. Two column addition caused the greatest trouble in Grade II where 32% of the pupils erred; Grade III showed 14% erring. Grade IV, with more difficult questions, involving a longer attention span, erred in 18% of the cases. But the higher grades showed little error in carrying. Subtraction presented a particular problem in borrowing which decreased from 25% in Grade II to 6% in Grade VI. The difficulties involved with zeros showed a decrease from 33% in Grade II to 18% in Grade IV, 6% in Grade V and 2% in Grade VIII. Multiplication of integers did not show as proportionate a decrease of errors throughout the grades. 74% in Grade III showed weakness in tables; while Grade IV showed a decrease to 36%; Grade V and VI showed errors of 32% and 28% respectively. The difficulty of carrying in multiplication was not apparent above Grade IV. Grade III and IV had difficulty when there were zeros involved but this type of error did not appear in the tests given the higher grades. As was shown in the other operations, the chief fault in division was lack of correct knowledge of fundamental combinations. Errors of this type decreased from 80% in Grade III to 40% in Grade VI. 50% of Grade IV pupils had difficulties with zeros in division. The errors manifested in the fundamental operations also appeared in denominate number relationships. But there was a decrease in the percentage of errors from 48% to 16% in Grade V. Errors in fractions arose from faulty procedures rather than from weakness in number combinations.

There is a tendency to hurry the learning of the number

combinations in the lower grades without due regard for the more thorough method of providing active experience to associate with the new concepts. The general belief predominates that drill will correct errors and that they will disappear in the higher grades. It is apparent from the above discussion that the frequency of certain errors of procedure does lessen significantly, although many important concepts are still not comprehended in the higher grades. It cannot be assumed that continued practice without careful remedial teaching will remove errors in number combinations.

Denominate numbers demand another body of factual knowledge. There is not the same opportunity for comparison of errors, for each grade studies new denominate relationships. All the grades showed weakness in the knowledge of the denominate tables in the particular course for the grade. But the decreasing percentage of errors demonstrated from 96% in Grade III to 45% in Grade VIII resulted from each grade doing more correctly the questions on the previous years' work. It would appear that in the relationships in one system, practise helped. But students even in the higher grades did not show knowledge of relationships between English and Metric Systems in length, for example. It would appear that inexperience with the metric system is the chief factor contributing to the weakness here. It may be concluded that denominate relationships can only be effectively learned through activity either incidental or directed.

There is a general suggestion that active experiences have been lacking in the presentation of arithmetic to the pupils who wrote these tests. There were of course errors that could not be analyzed from the written work shown. These were examples of faulty reading or poor use of fractions. But the outstanding difficulty arises from the lack of a meaningful understanding in a practical setting. Activity programs in schools must have meaning for the pupils.

It is implied that all activity must be thought of ahead of time by the teacher so that there is some guarantee of a satisfactory result. Arithmetic idea, it may be stated, have a background of mental ideas which are outgrowths of experience. But the experience, representative of purposeful activity must be so directed as to culminate in the desired idea. The problem, according to this theory, is not clear or concrete unless the pupil can form an image. It cannot always be said conclusively that the child did not read carefully. The confusion of perimeter and area in Grades IV and V suggests lack of experience with concrete materials in measuring and comparing. It was obvious that many students did not understand the numerical value of decimals. The various types of errors described in Chapter VI indicate the lack of use of decimals in meaningful experience. It is important that pupils should learn that decimals are an extension of the notation system to the right of the decimal point. It is not intended to give an extensive symbolism beyond the demands of practical use; but it is significant that knowledge implies more than a grasp of symbolism separate from everyday usage.

Faulty procedure in problem solving indicates lack of visualization of the experience involved. Of course it is not maintained that every form of experience can be organized for the classroom; but it is maintained that sufficient meaningful experiences involving the use of numbers in various relationships can be so organized as to give a pupil a clear conception of their significance. A student in Physics is expected to do problems to demonstrate his grasp of a scientific principle. The child in arithmetic must find the significance of his number symbolism in practical, meaningful activity carefully organized by a resourceful teacher who has a clear idea of the purpose intended. There is evidence that fundamentals are drilled by mechanical processes. Pupils cannot decide what procedure to use if their drill has been separate from any form of visualization

of the problem involved. As was said at the end of Chapter V, more emphasis must be attached to the recognition of procedures and exactness of form.

There is a tendency to believe that formal statements in arithmetic should be avoided. But it is a point commonly propounded that putting down in a formal statement what is given and what is required is one method of developing in a child a sense of analysis that appears to have been lacking in the problem sections of these tests. Meaningful activity is important to understanding but facility in expressing that understanding in precise language arises from practise of it; and precision of expression implies precision of thinking which is fundamental in problem solving. Formal statements in Grade III should, according to the Course of Study be avoided but in later grades it would appear advantageous, particularly where the language of arithmetic is to be emphasized. It is the intention of the Course to emphasize the definite conciseness of the language as a vehicle for clear-cut expression of organized thought processes. There is evidence of unfamiliarity with the language. Pupils did not know when to subtract but no doubt would have done so if the instructions had read "Take away". Many refer to a product or a quotient as an answer and showed their unfamiliarity with the words both in use and in spelling.

The general conclusion of all this is that teachers should be familiar with the psychology of arithmetic, the classes of errors that occur, and the difficulties involved from the pupils' standpoint. There is evidence of the need of more definite Normal School training in this matter. It would appear that outlines of the common problems and norms of accomplishment in various operations might serve a very useful purpose if printed in the course of study for each grade. Along with them might be included forms of charts or record sheets which the teacher might use as a guide in

keeping individual records of the problems of the pupils. It is obvious that no effective work can be done in improving arithmetic, without regard for the values of efficient diagnosis and recording of difficulties for remedial instruction.

Survey Tests can be more effectively utilized in such a program when the significance of their potentiality is fully appreciated by all those concerned with instruction in arithmetic.

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